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DEPARTMENT OF THE ARMY FIELD MANUAL

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8-INCH HOWITZER M2, TOWED

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CHANGE } HEADQUARTERS
No. 1 } DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 27 June 1967

8-INCH HOWITZER M115, TOWED

FM 6-90, 21 November 1962, is changed as follows:

Title of manual is changed to read "8-INCH HOWITZER M115, TOWED."

Page 1, paragraph 1a. In line 3, "M2" is changed to read "M115."

Page 3, paragraph 1d. In line 5, "lery and Missile School, Fort Sill, Okla" is changed to read "lery and Missile School, ATTN: AKPSIAS-PL-FM, Fort Sill, Okla. 73503."

Page 5, paragraph 4. In line 2, "M2" is changed to read "M115."

Page 6, paragraph 5b. In line 1 the following is added "for section drill".

Page 13, paragraph 16b. Line 2 is changed to read as follows: "occupation is governed by time factors, personnel available, and unit".

Page 17, paragraph 18. In lines 5 and 6 "(aiming posts or distant aiming point)" is changed to read "(infinity-aiming reference collimator aiming posts or distant aiming point)." At the end of line 10 "See figure 7.1" is added.

Page 18. Paragraph 20c is rescinded.

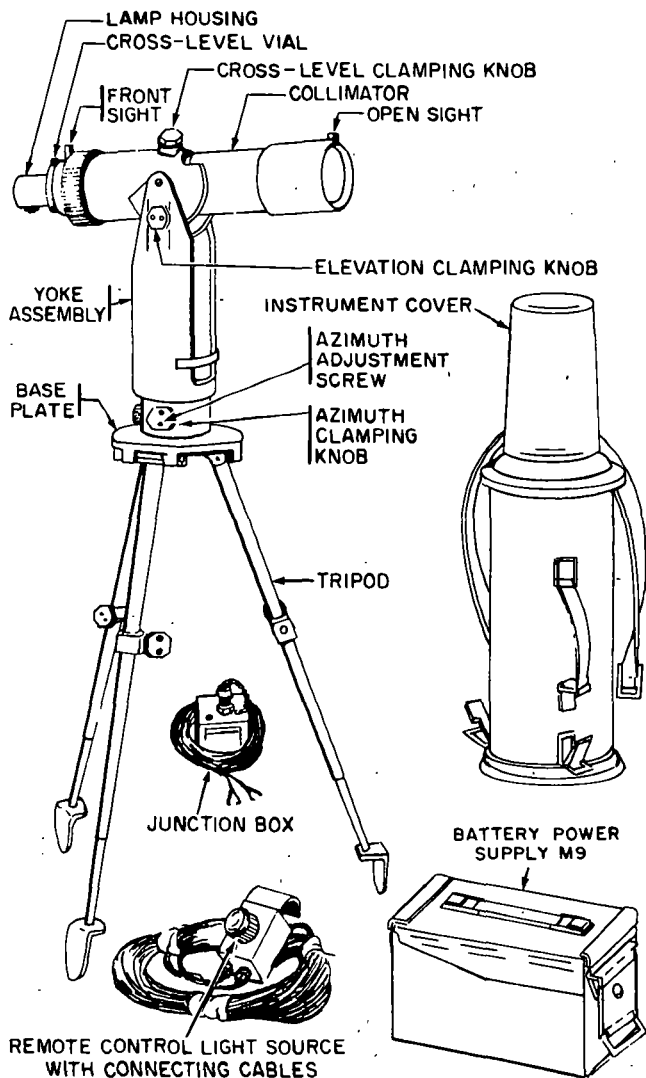


Figure 7.1 Infinity-aiming reference collimator and auxiliary equipment.

Page 22. Paragraph 24c(2) is superseded as follows:

- (2) (The corresponding number(s) (graduations) on the panoramic telescope must be matched with the corresponding number(s) on the reticle of the infinity-aiming reference collimator, or the vertical reticle of the panoramic telescope must be alined with the left edge of the aiming posts.

Page 22, paragraph 25a. In lines 2 and 3 "normally aiming posts and alternate" is changed to read "normally the infinity-aiming reference collimator, or the aiming posts, or alternate."

Page 24. Paragraph 25c is added as follows:

c. The collimator may be positioned 4 to 17 meters to the left front of the panoramic telescope sight, at a deflection established by unit SOP. However, the best results are obtained from 5 to 12 meters depending on the weapon.

- (1) While the howitzer is being laid, number 5 cannoneer alines the optical system of the collimator on the center of the panoramic telescope rotating head and cross-levels the reticle pattern.
- (2) After the howitzer is laid the gunner directs number 5 in alining to 0 line of the reference collimator reticle with the vertical reticle of the panoramic telescope.
- (3) To lay for direction during firing, the gunner sets the announced deflection on

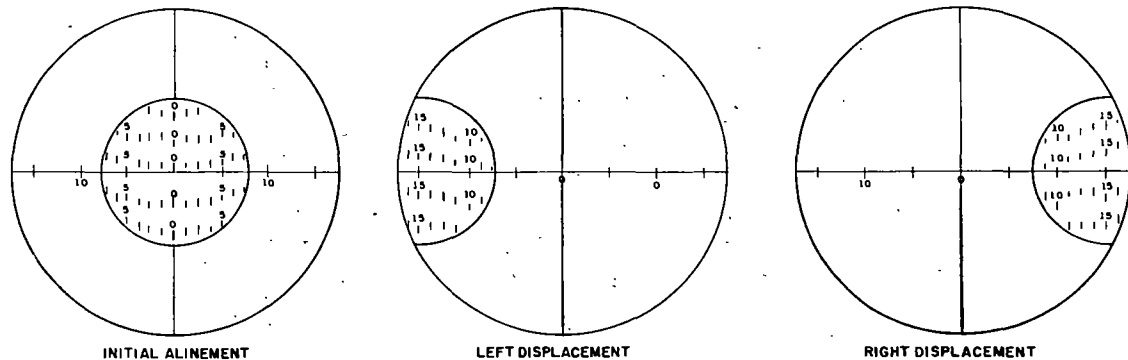


Figure 8.1 Gunners sight picture of collimator when correcting for displacement.

the panoramic telescope and aligns any number on the panoramic telescope reticle with the same number on the collimator reticle. This procedure for laying also compensates for weapon displacement during firing. See figure 8.1.

Note. For positive location, an area of at least 7 mils in diameter or two significant numbers must be seen at all times on the collimator reticle.

Page 24. Figure 8.1 is added as follows:

Page 29, paragraph 30a. In line 2, "M2" is changed to read "M115."

Page 32, paragraph 32b. Line 3 is changed to read "limits of elevation."

Page 35. Paragraph 35a(3) is rescinded.

Page 46, paragraph 43g. In line 1: "and" is changed to read "or."

Page 55. Paragraph 50d is rescinded. Transfer the note to follow subparagraph e.

Page 60, paragraph 60d. In line 2, "M2" is changed to read "M115."

Page 72, paragraph 77. In the subject column, lines 5 and 6 are changed to read "Infinity-aiming reference collimator, or aiming post displacement correction."

Page 75, paragraph 78a. In line 3, "M2" is changed to read "M115."

Page 75. Paragraph 79c is superseded as follows:

c. The corresponding number(s) on the panoramic telescope must be matched with the cor-

responding number(s) on the reticle of the infinity-aiming reference collimator or the vertical reticle in the panoramic telescope must be aligned on the left edge of the aiming post or on the same part of the aiming point or target each time the howitzer is laid.

Page 79, paragraph 86b. In line 2, "600" is changed to read "400."

Page 80, paragraph 86c. In column 2, line 3, "600" is changed to read "400."

Page 81, paragraph 87b(1). In line 2, "600" is changed to read "400."

Page 83. Paragraph 88b(5) is superseded as follows:

(5) The reference collimator or the aiming posts will be set out at the deflection as determined by unit SOP.

Page 83, paragraph 88c. In column 3, lines 4 and 5, "until the vertical hairline of the" is changed to read "until corresponding numbers on the panoramic telescope coincide with those on the reference collimator or the vertical reticle of the". Line 14, "Lays on aiming posts" is changed to read "Lays on reference collimator or aiming posts." In column 2, line 9, "CEASE" is changed to read "CHECK". Delete "(No time considered for this operation)."

Page 84, paragraph 88c. In column 3, line 11, delete "hairline of the."

Page 84. Paragraph 88d(1)(c) is superseded as follows:

- (c) The corresponding number(s) on the reticle of the panoramic telescope does not coincide exactly with the same number(s) on the reference collimator or the vertical reticle of the telescope is not on the aiming point or left edge of the aiming posts, as the case may be.

Page 88, paragraph 91b. Subparagraphs (1), (2), and (4) are superseded as follows:

- (1) Infinity-aiming reference collimator or aiming posts will be set out at the prescribed distances.
- (2) An assistant, selected by the candidate, will be stationed close to the reference collimator or the far aiming post.
- (4) Then the azimuth adjustment screw on the reference collimator or the far aiming post will be moved so that a displacement of 5 to 10 mils occurs.

Page 89, paragraph 91c(1). In column 2, line 1, delete "Lays" and add the following: "The gunner sights on the collimator and matches the reticle of the panoramic telescope with the collimator reticle pattern or lays."

Page 89, paragraph 91c(2). In column 1, "ALINE AIMING POSTS" is changed to read "ALINE REFERENCE COLLIMATOR OR AIMING POSTS." In column 2, line 1, "alining aim-" is changed to read "alining the reference collimator or aim-"

Page 89. Paragraph 91d(1)(a) is superseded as follows:

- (a) The corresponding number(s) on the reticle of the panoramic telescope does not coincide exactly with the same number(s) on the reference collimator or the far aiming post does not appear midway between the near post and the vertical reticle of the telescope.

Page 90, paragraph 91d(2). Subparagraphs (b) and (c) are superseded as follows:

- (b) The reference collimator or the aiming posts are not properly alined.
- (c) The corresponding number(s) on the panoramic telescope is not matched with the corresponding number(s) on the reticle of the reference collimator or the vertical reticle of the telescope is not on the left edge of the aiming posts.

Page 92, paragraph 93b. Subparagraphs (1) and (2) are superseded as follows:

- (1) The howitzer will be laid on the reference collimator or the aiming posts to the left front.
- (2) An aiming point within 200 mils to the left or right of the reference collimator or aiming posts will be designated by the examiner and identified by the candidate.

Table II, sequence 8. Chief of Section column, line 21, "until the aiming" is changed to read "until the reference collimator or aiming." In the Gunner column the following is added before

the first sentence. "Districts alinement of the infinity-aiming reference collimator:

1. Sets the panoramic telescope at deflection 2600.
2. Illuminates reference collimator reticle and refers the panoramic telescope to the center of the reticle.
3. Assisted by number 5, alines the vertical of the panoramic telescope with the 0 lines on the reference collimator. (Minor adjustments may be made by both the gunner and number 5 to insure exact coincidence.)"

Sequence 8, number 5 column. In line 1 "Sets" is deleted and the following is added: "Assists the gunner to orient the infinity-aiming reference collimator. If required sets."

Sequence 5, number 5 column. "Assembles aiming posts *** front of howitzer" is deleted and the following is added: "Prepares and emplaces the infinity-aiming reference collimator in a convient location, to the left front of the direction of fire, from 17 to 35 feet from the weapon.

1. Orients collimator on the panoramic telescope and cross-levels the reticle.
2. Lays electrical cable from the collimator to the gunner's position. (If required, assembles aiming posts and places these near left front of howitzer.)"

Table III, Chief of Section column. In lines 46 and 62 "CEASE" is changed to read "CHECK".

Gunner column. Line 2, item 3 is superseded as follows:

3. Traverses the piece until a number on the telescope reticle is matched with the same number on the reference collimator reticle, or until the vertical line of the telescope is on the left edge of the aiming point. After line 46 the following note is added:

Note. When using the reference collimator, matching the same number(s) on the telescope and collimator reticles in the direction of displacement compensates for any displacement.

Number 9 column. Lines 20 and 21 are changed to read "fuzes: M520, M562, M563, M564, and M565." In line 80, "M500" is changed to read "M20"

Table IV is superseded as follows:

Table IV. Trajectory Characteristics, Shell HE, Charge 7
(Located in back of manual)

Table V. Chief of Section column, under **Ammunition and fuze selection*: item 2 is rescinded.

Table VI, sequence 1. In number 5 column, lines 1 and 2 are deleted and the following is added: "Recovers, disassembles, and stows the reference collimator (aiming posts if required)."

By Order of the Secretary of the Army:

Official: HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-11 requirements for 8-inch Howitzer, M115, Towed.

☆ U.S. Government Printing Office: 1967—305-576/5469C

Table IV. Trajectory Characteristics, Shell HE, Charge 7

Range (meters)	Elevation (mils)	Vertical displacement per 100-meter range change (feet)	Trajectory Characteristics	
100	1	0.5	For ranges from 0 to 500 meters, the trajectory is flat enough to prevent an 8-foot tank from passing under it. 400 meters is the ideal range at which to open fire on a target.	Start firing with the data for the estimated range at the closest 100-meter range.
200	3	1.0		
300	4	1.0		
400	6	1.5		
500	7	2.0		
600	9	2.5	For ranges between 600 and 1,400 meters, adjustment of fire on the target by bracketing is required. 200 meter range changes should be made until a bracket is obtained.	1. Start firing with the estimated range at the closest 100 meter range line. 2. Bracket adjustment of the target (overs and shorts) is required. 3. Make 200 meter range changes until a bracket is obtained.
700	10	3.0		
800	12	3.5		
900	14	4.0		
1,000	15	4.5		
1,100	16	5.0		
1,200	18	5.5		
1,300	20	6.0		
1,400	21	6.5		
1,500	23	7.0	At ranges over 1,400 meters, bracket adjustment of the target is also required. 400 meter range changes should be made until a bracket is obtained.	1. Start firing with the estimated range at the closest 100 meter range line. 2. Bracket adjustment of the target (overs and shorts) is required. 3. Make 400 meter range changes until a bracket is obtained.
1,600	24	8.0		
1,700	26	8.5		
1,800	28	9.0		
1,900	30	9.5		
2,000	31	10.5		
2,100	33	11.0		
2,200	35	12.0		
2,300	36	12.5		
2,400	38	13.0		
2,500	40	13.5		



FIELD MANUAL	{	HEADQUARTERS,
No. 6-90		DEPARTMENT OF THE ARMY
		WASHINGTON 25, D.C., 21 November 1962

8-INCH HOWITZER M2, TOWED

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*This manual supersedes FM 6-90, 9 January 1961.

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CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders and chiefs of section in developing the towed 8-inch howitzer M2 sections into teams that will operate effectively in battle.

b. This manual prescribes duties of the *section* in —

- (1) Section drill.
- (2) Preparation for firing and traveling.
- (3) Firing.
- (4) Tests and adjustments.
- (5) Maintenance and inspections.
- (6) Decontamination of equipment.
- (7) Destruction of equipment.

c. This manual is applicable to both nuclear and nonnuclear warfare without modification.

d. To improve this manual, users are encouraged to submit changes and comments keyed to the specific page, paragraph, and line, with supporting reasons, direct to Commandant, U.S. Army Artillery and Missile School, Fort Sill, Okla.

2. Composition of the Howitzer Section

(figs. 1 and 2)

- a. Chief of section (CS).
- b. Gunner (G).
- c. Assistant gunner (AG).

- d. Cannoneers number 1 through 10.
- e. Driver (D).

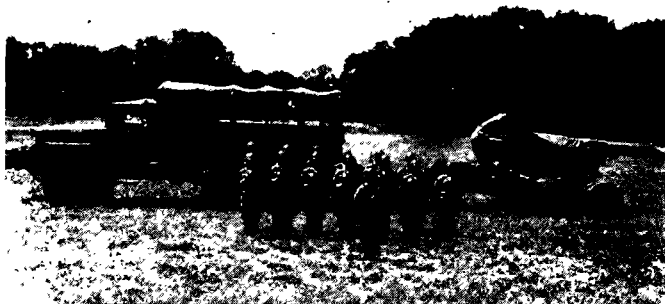


Figure 1. 8-inch howitzer M2, towed; howitzer section; and prime mover.

3. Duties of the Chief of Section

The chief of section is the noncommissioned officer in command of the section. He is responsible for —

- a. Training and efficiency of personnel.
- b. Performance of duties in drill, firing, tests and adjustments, inspection, and maintenance.
- c. Observance of safety precautions.
- d. Preparation of field fortifications.
- e. Camouflage discipline, local security, and chemical, biological, and radiological security discipline.
- f. Maintenance of equipment log book (TM 38-750).
- g. Police and improvement of the section area.



Figure 2. Section equipment.

4. References

Publications applicable to the 8-inch howitzer M2, towed, are listed in the appendix.

CHAPTER 2

SECTION DRILL

Section I. GENERAL

5. Purpose

This chapter prescribes —

- a.* Objectives and instructions for section drill.
- b.* Commands and formations.

6. Objective

The objective of section drill is the attainment of efficiency and precision, coupled with high speed.

7. Instructions

Section drill will be—

- a.* Conducted in silence except for commands and reports.
- b.* Repeated until reactions are automatic, rapid, and efficient.
- c.* Supervised so that mistakes will be discovered, reported, and corrected immediately.
- d.* Supervised by battery officers to insure uniformity and efficiency.
- e.* Conducted so that each member of the section can perform all duties within the section.

Section II. COMMANDS AND FORMATIONS

8. Forming the Section

To form the section, the chief of section takes his post and gives one of the following commands:

a. To form the section, the chief of section commands FALL IN. The section —

- (1) Moves at double time.
- (2) Forms in a double rank at close interval, with the gunner and assistant gunner on the right in the first and second ranks, respectively; the cannoneers in numerical order; and the driver at the left of the second rank.
- (3) Centers on the chief of section at a distance of 3 paces (fig. 3).

b. To form the section in a particular place, the commands may be 1. IN FRONT (REAR) OF YOUR PIECE, 2. FALL IN. The section —

- (1) Moves and forms as in *a* above.
- (2) Faces the direction of fire.

c. To form the section in a particular direction the commands may be 1. ON THE ROAD FACING THE PARK, 2. FALL IN. The section —

- (1) Moves and forms as in *a* above.
- (2) Faces direction indicated in the command.

d. At the first formation for a drill or exercise the caution "As a section" precedes the command.

9. To Call Off

With the section in formation the command is CALL OFF.

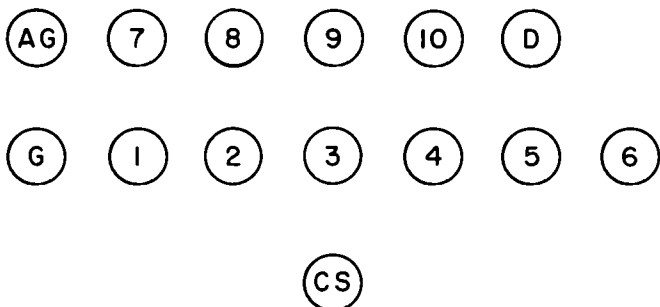


Figure 3. Section in formation.

a. All personnel except the gunner and assistant gunner execute eyes right.

b. The section calls off in sequence: "Gunner," "1," "2," "3," "4," "5," "6," "Assistant gunner," "7," "8," "9," "10," and "Driver."

c. As each man calls out, he turns his head smartly to the front.

10. To Take Posts

The command is 1. CANNONEERS, 2. POSTS.

a. The command is general and may be given when the section is in or out of ranks, at a halt, or marching.

b. All movements are executed at double time and are terminated at the position of attention.

c. The section moves to posts as shown in—

- (1) Figure 4, dismounted, howitzer coupled.
- (2) Figure 5, howitzer section mounted.
- (3) Figure 6, prepared for action.
- (4) Figure 7, howitzer uncoupled, not prepared for action.

11. To Change Posts

To train all members of the section in all duties, posts should be changed frequently. With the section in *formation* (fig. 3), the commands are as follows:

a. 1. CHANGE POSTS, 2. MARCH.

- (1) Numbers 6 and 10 move at double time in the rear of their ranks to the posts of number 1 and the assistant gunner, respectively.
- (2) Numbers 1 through 5 and numbers 7 through 9 take two left steps taking the positions of the next higher numbered cannoneers, and the assistant gunner takes two left steps taking the position of number 7.

b. 1. SECTION CHANGE POSTS, 2. MARCH.

- (1) The leftmost men move at double time to the posts of gunner and assistant gunner, respectively.
- (2) All other men move as in *a* above.

12. To Mount

To mount, the following commands may be given:

a. 1. PREPARE TO MOUNT, 2. MOUNT.

- (1) At the preparatory command, the section moves at double time to position shown in figure 4.
- (2) At the command of execution, personnel mount and take positions as shown in figure 5.

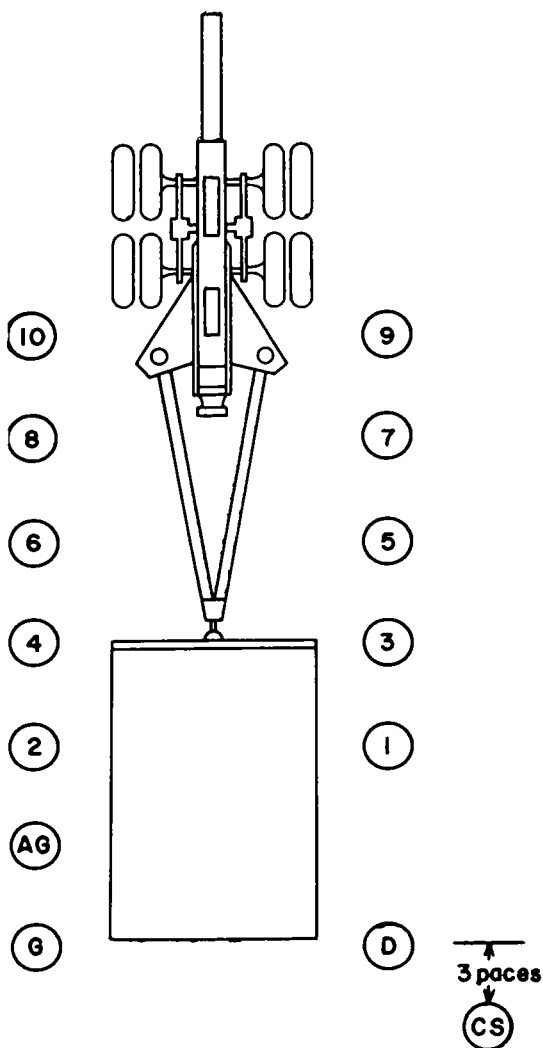


Figure 4. Posts, dismounted.

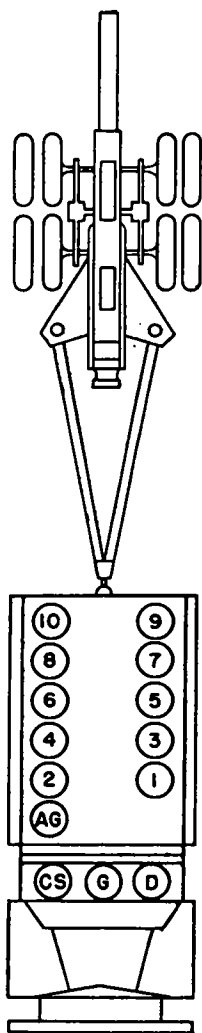


Figure 5. Howitzer section mounted.

- (3) If any member of the section is not to mount, he is designated and cautioned by "Stand fast." 1. PREPARE TO MOUNT, driver stand fast, 2. MOUNT.

b. MOUNT. The section moves directly to positions shown in figure 5.

13. To Dismount

To dismount, the following commands may be given:

- a. 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

(1) At the preparatory command, the section assumes positions for rapid dismounting.

(2) At the command of execution, the personnel take positions as shown in figure 4.

b. DISMOUNT. The section moves without delay to positions shown in figure 4.

14. To Fall Out

The command FALL OUT is given to provide rest and relief during drill or firing.

- a. *During Drill.*

(1) The command may be given at any time.

(2) Section remains in vicinity of drill area.

- b. *When Firing.*

(1) The command is given when firing is temporarily suspended.

(2) Section remains in the vicinity but clear of the piece.

(3) Settings and layings are not disturbed.

CHAPTER 3

DUTIES OF THE HOWITZER SECTION

Section I. PREPARATIONS FOR FIRING

15. Purpose

This chapter prescribes duties for —

- a. Uncoupling the howitzer (table I).
- b. Preparing the howitzer for action (table II).
- c. Firing by indirect laying (table III).
- d. Firing by direct laying (table V).
- e. Preparing the howitzer for march order (table VI).
- f. Coupling the howitzer (table VII).

16. At the Position

a. The howitzer is emplaced under direct supervision of the chief of section.

b. Preparation of the firing position prior to occupation is governed by time factors and unit standing operating procedures (SOP). The following preparations will facilitate the occupation:

- (1) Mark the position with a stake where the center of the carriage is to be placed.
 - (2) At a distance of 50 to 100 meters in the approximate direction of fire, place another stake toward which the driver can point the tube.
- c. Hand signals are used for guiding the driver.

17. To Prepare for Action

a. The command is **PREPARE FOR ACTION**.

- (1) It may be given with the howitzer in position or approaching it.
- (2) To uncouple, the command is **UNCOUPLE**.
- (3) Duties of individuals are given in tables I and II.
- (4) Each man takes his post (fig. 6) when he has completed his duties.

Table I. Duties in Uncoupling

(Located in back of manual)

Table II. Duties in Preparing for Action

(Located in back of manual)

b. The howitzer normally is partially prepared for action prior to reaching the firing position.

c. All duties are conducted at double time.

d. If the howitzer is to be uncoupled but not prepared for action at the firing position, the caution "Do not prepare for action" must precede the command **UNCOUPLE**. When their duties are completed, the section moves to the posts shown in figure 7.

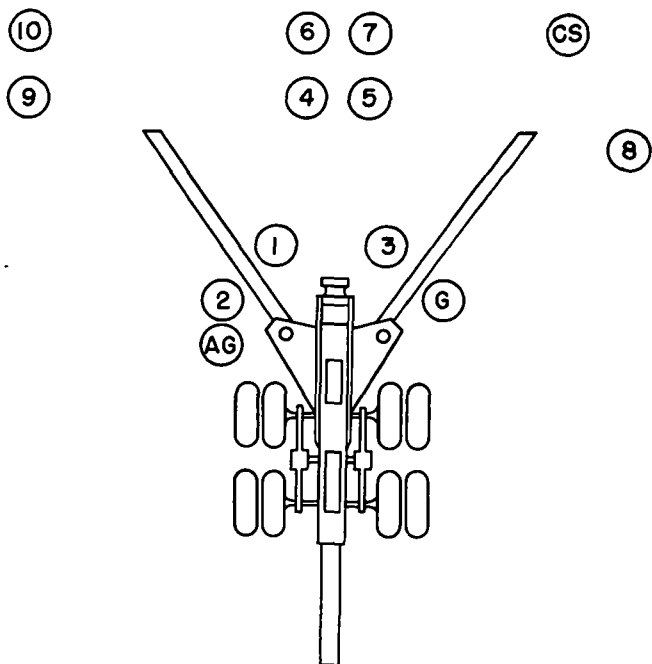


Figure 6. Posts, prepared for action.

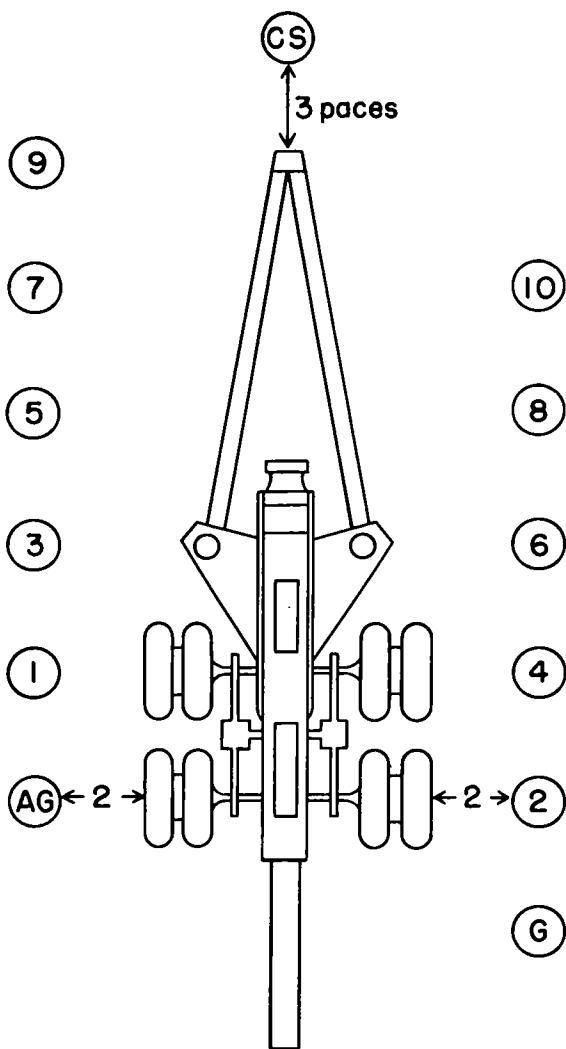


Figure 7. Howitzer uncoupled, not prepared for action.

Section II. FIRING

18. Firing by Indirect Laying

The vast majority of targets will be attacked by indirect laying. Indirect laying is a method of taking targets under fire by placing the line of sight of the panoramic telescope on an aiming point other than the target (aiming posts or distant aiming point). To provide timely and accurate fire, the section must be indoctrinated with a sense of urgency. Every effort must be made to execute the timely and effective delivery of fire. A detailed list of duties is contained in table II.

19. Firing by Direct Laying

Some targets may be attacked by direct laying. This is a method of taking the target under fire by sighting directly on the target. Since such targets are usually capable of returning fire, the following factors must be emphasized:

- a. Speed and accuracy in laying.
- b. High standards of training.
- c. Section operation as an independent unit.

20. Methods

a. *Two-Man, Two-Sight System.* The two-man, two-sight system is the principal sighting system used with the weapon.

- (1) The gunner establishes lead (table V) with the panoramic telescope.
- (2) The assistant gunner establishes range with the elbow telescope.

b. *One-Man, One-Sight Systems.* The one-man,

one-sight system, in which the gunner lays for both deflection and elevation may be used against stationary targets only. The two-man, two-sight system, however, provides faster laying, better accuracy, and a greater assurance of first round hits.

c. Laying Method. Central laying is used in conjunction with click sights.

- (1) The gunner sets the lead on the azimuth micrometer index and traverses the tube until the vertical hairline is on the center of the target.
- (2) Subsequent changes in lead are made in 5-mil increments by sound (clicks) and feel when turning the azimuth micrometer knob.

d. Tracking the Target. After lead and range are laid on the target, continuous tracking is maintained during the firing sequence.

e. Specific Duties in Firing. Specific duties in firing by direct laying are shown in table III.

Table III. Duties in Firing, Indirect Laying
(Located in back of manual)

21. Range Card

a. The chief of section is responsible for the defense of his assigned sector. Further, he should be prepared to deliver fire in all sectors (directions).

b. During reconnaissance of the position and shortly after occupation of position, the chief of section—

- (1) Measures or estimates the ranges to prominent terrain features and likely avenues or approach.
- (2) Establishes reference points as required.
- (3) Prepares a range card (fig. 8).
- (4) As time permits, replaces estimated ranges with more accurate ranges obtained by pacing, taping, speedometer, maps, or survey.

c. The executive officer assigns numbers to certain prominent terrain features to facilitate target identification. For example, the executive commands TARGET, TANKS, POINT NUMBER 2, FIRE AT WILL.

d. As time permits, a deflection and a quadrant for each numbered point should be added to the range card to both expedite and increase accuracy in firing.

e. The section field of fire should, if possible, be cleared of obstruction that might—

- (1) Obstruct fields of fire.
- (2) Hinder observation.

f. Care must be taken not to expose the location of the position.

22. Trajectory Characteristics

Trajectory characteristics for different ranges must be considered prior to taking a target under fire. Table IV provides data and information covering the effective direct fire ranges of the weapon.

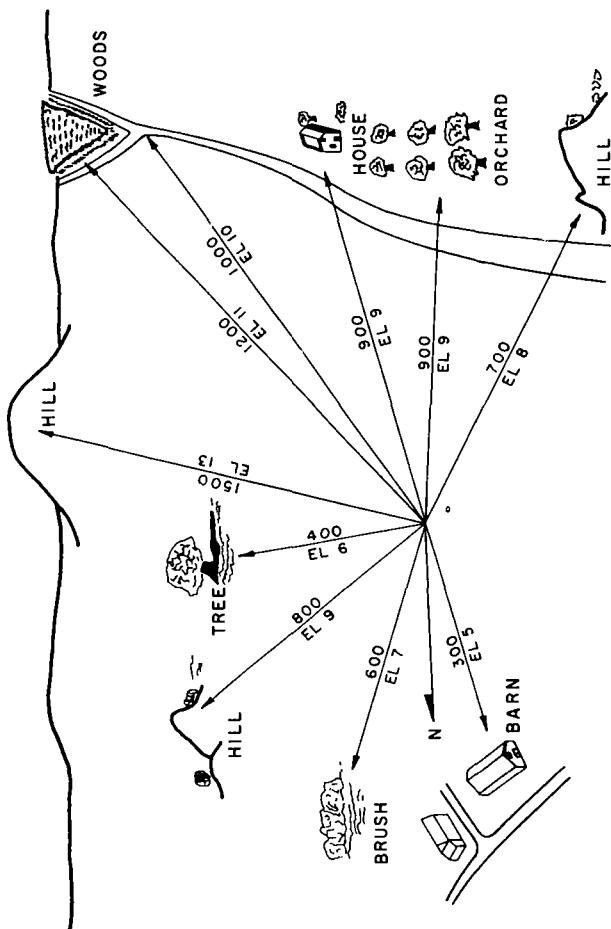


Figure 8. Range Card for direct laying.

23. Preparation for Traveling

a. The command is MARCH ORDER. Duties of individuals are given in table VI.

b. To couple, the command is COUPLE.

(1) Duties of individuals are given in table VII.

(2) Each man takes his post (fig. 4) when he has completed his duties.

Table IV. Trajectory Characteristics, Shell HE, Charge 7
(Located in back of manual)

Table V. Duties in Direct Laying
(Located in back of manual)

Table VI. Duties in March Order
(Located in back of manual)

Table VII. Duties in Coupling
(Located in back of manual)

CHAPTER 4

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

24. Precision in Laying

a. Fire control instruments, fuze setters, and elevation and traverse mechanisms must be operated to reduce the effects of lost motion.

b. The gunner and assistant gunner verify the laying after the breech is closed.

c. For uniformity and accuracy—

(1) The line of sight for setting and reading a scale or centering a bubble should be at a right angle to the scale or level vial to prevent parallax errors.

(2) The vertical hairline of the panoramic telescope should be alined with the left edge of the aiming post.

25. Aiming Points and Aiming Posts

a. After the howitzer is laid for direction, it is referred to a primary aiming point, normally aiming posts and alternate aiming points (distant aiming points) as required.

(1) An aiming point must be a sharply defined point or a clearly visible vertical line.

(2) Alternate aiming points (distant aiming points) must be at a distance of at least 3,000 meters. This distance prevents dis-

placement in firing or traverse from causing more than a $\frac{1}{2}$ -mil horizontal change with the same settings on the scales.

b. The aiming posts are placed in alinement with the vertical hairline of the panoramic telescope, as directed by the gunner.

- (1) The *far* aiming post is placed at least 100 meters from the piece. This distance is the most desirable for accuracy, visibility, and control of the aiming post lights.
- (2) The *near* aiming post is set up halfway between the far post and the piece. Equal spacing is accomplished either by pacing or by measuring with the panoramic telescope and using the aiming post as a stadia rod or by using a wire or cord with the appropriate distances marked in a convenient manner.
- (3) When the aiming post is used as a stadia rod, the procedure is as follows:
 - (a) Number 5 stands at the far aiming post and holds the upper section of the aiming post parallel to the ground so that the long axis is perpendicular to the line of sight.
 - (b) The gunner measures the length of the aiming post in mils on the reticle of the panoramic telescope.
 - (c) The gunner directs number 5 to move toward the piece until the upper section of the aiming post measures twice the number of mils it measured

at the far aiming post and directs number 5 to emplace the near aiming post.

- (4) For night use, the light on the far aiming post should be placed so that it appears to be several feet above the light on the near post. The lights placed in this manner establish a vertical line for laying the howitzer.
- (5) Unit standing operating procedure will specify the deflection at which to place the aiming posts; however, a deflection of 2,600 mils reduces misalignment and allows for maximum visibility.
- (6) Correction for displacement of the aiming posts from the vertical hairline of the panoramic telescope is discussed in table III.

26. Changes in Data During Firing

If it is necessary to change any element of firing data, the executive commands CORRECTION.

a. Piece Unloaded. If the piece is unloaded new data are set off and firing is resumed when the quadrant is announced.

b. Piece Loaded. If the piece is loaded—

- (1) New data are set off and firing is resumed when the quadrant is announced, if the fuze, time setting, or charge is not changed.
- (2) If the data requires a change in the fuze, time setting, or charge, the chief of section will suspend firing and report to the

executive "Number 2 (so-and-so) loaded, charge (such-and-such), fuze time (such-and-such)" stating the elements that are changed.

- (3) Data changes during continuous fire are applied so as not to stop the fire or break its continuity.

27. To Unload the Howitzer

a. A complete round, once loaded, should be fired. However, if unloading is required, the command is UNLOAD.

b. If the howitzer has been fired sufficiently to heat the tube, fire the piece if at all possible, or, if required, remove the round as quickly as possible.

c. Unloading will be supervised by an officer, and the procedure is as follows:

- (1) The assistant gunner operates the elevating handwheel and number 2 operates the elevating mechanism clutch to lower the tube to zero elevation.
- (2) Number 1 removes the firing mechanism, opens the breech, and receives the waste from number 3.
- (3) Number 3 removes the powder charge and passes it to number 8. Number 1 fills the chamber with waste and closes the breech.
- (4) The assistant gunner and number 2, assisted by numbers 4 and 5, insert the rammer head into the muzzle of the howitzer until the rammer head incloses the

fuze and contacts the projectile. Then, they apply steadily increasing pressure, tapping the end of the rammer staff if necessary, until the projectile is loosened.

- (5) When the projectile is loosened, the ramming operation is suspended. Number 1 opens the breech, removes the waste, and passes it to number 3. Numbers 6 and 7 and numbers 8 and 9 place the loading tray in position in the breech recess. Number 7 holds a pickax handle (or extra rammer if available) firmly against the base of the projectile to steady it as it is removed.
- (6) Rammer staff operators ((4) above) slowly push the projectile back onto the loading tray. After the projectile is unloaded ((5) above), it is disposed of as directed by the chief of section.

d. For further information on unloading, see TM 9-3004.

e. In case of a misfire, the instructions in TM 9-3004 will be followed.

28. Care of Ammunition

To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, great care must be exercised in handling and storing ammunition. The following requirements should be met:

a. Instructions in TM 9-1900 applicable to field service should be followed.

b. Projectiles will be protected from damage by—

- (1) Removing the eyebolts only when the fuze is to be inserted.
- (2) Using tarpaulins and dunnage to protect ammunition against weather, dirt, and sun.
- (3) Stacking projectiles in the open and raising the stacks 6 inches off the ground. Drainage ditches should be dug around the stacks.
- (4) Using dunnage liberally between ammunition layers and providing a 6-inch air space between the top of the stack and the covering tarpaulin.

c. Propellant charges will be—

- (1) Protected from direct rays of the sun and moisture.
- (2) Left in containers until just prior to firing.

Note. Uniform propellant temperatures must be maintained to provide accurate firing.

d. Explosive elements in primers and fuzes are particularly sensitive to shock and high temperatures. Handling is as follows:

- (1) Protect from weather, direct sunlight, and rough handling.
- (2) Protection and safety devices are removed from fuzes just prior to their use.
- (3) No attempt will be made to disassemble a fuze.

e. Protection against enemy fire may be provided by—

(1) Dispersing ammunition in small stacks. Each stack should contain not more than 25 rounds and should be only one layer high, and the stacks should be placed at least 10 meters apart.

(2) Storing ammunition in trenches and dug-outs.

f. Projectile and powder charges should be sorted into lot numbers as they are stored.

g. For further information on care of ammunition, see FM 6-40, FM 6-140, TM 9-1300-203, TM 9-1900, and the appropriate operator's manual.

h. For care and handling of nuclear ammunition, see (S) TM 39-B33-9, (S) TM 9-1100-218-20P, (S) TM 39-N-7, and (S) TM 39-N-13.

CHAPTER 5

BORESIGHTING

Section I. GENERAL

29. Description

Boresighting is —

a. The process used to *verify* and *aline*, if required, the optical axes of the panoramic telescope and the elbow telescope so that they are parallel to the axis of the tube in deflection and elevation.

b. Conducted prior to firing and, when necessary, during lulls in firing.

c. A method to insure accuracy in laying for elevation and direction.

30. Methods of Boresighting

a. The four methods for boresighting the 8-inch howitzer M2, towed, are—

(1) Testing target method (pars. 33–35).

(2) Distant aiming point method (pars. 36–38).

(3) Aiming circle method (pars. 39–41).

(4) Standard angle method (pars. 42–44).

b. The method of boresighting will be determined by unit standing operating procedure and time available.

31. Equipment

The following equipment is needed to boresight the weapon using the testing target method:

a. Front and Rear Boresights.

- (1) The front and rear boresights provide a means for alining the tube on the testing target or distant aiming point.
- (2) If boresights are not available, crosshairs are fastened to the muzzle, and the obturator spindle vent is used as a rear sighting guide by removing the firing mechanism from the closed breechblock.

b. Testing Target. The testing target provides accurate aiming diagrams for the tube, panoramic telescope, and elbow telescope in boresighting and testing. The testing target is prepared as follows:

- (1) Mount a flat piece of material on a stand to provide stability (fig. 9).
- (2) Inscribe a mil scale for use in leveling or canting the target (fig. 9).
- (3) Draw vertical reference lines for use when the trunnions are not level (fig. 9).
- (4) Bore a $\frac{1}{16}$ -inch hole through the center of each aiming diagram and cover each hole with a piece of heavy cloth. For nighttime use the aiming diagram may be illuminated by placing a flashlight against the hole. The resulting dot of light is used as the aiming point.

c. Tools. Section equipment includes all tools necessary for boresighting and testing.

Note. Use the proper tools to prevent damage to fire control equipment.

d. Plumb Line. The plumb line is used to level the trunnions for testing, and for boresighting if

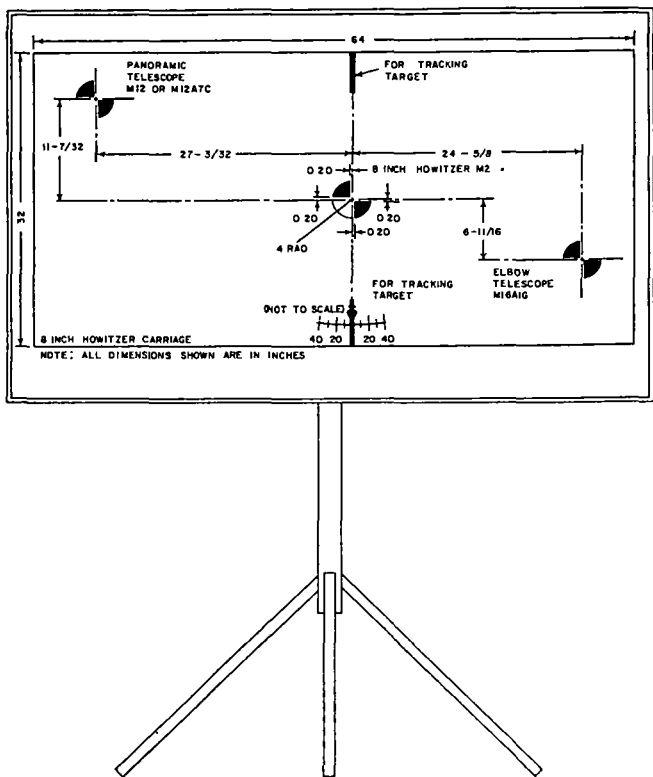


Figure 9. Testing target.

time is not a factor. The plumb line is prepared as follows :

- (1) Suspend the line from any convenient location so that the muzzle of the howitzer can be placed at a distance approximately 5 feet from the line.
- (2) For the most accurate test, insure that the line is long enough to allow sighting down the tube at the highest elevation possible.
- (3) Attach a weight to the end of the line to maintain tautness and place the weight in a liquid-filled container to prevent the line from swinging.

32. Requirements for On-Carriage Fire Control Alinement

Correct alinement exists when—

- a. The mounts and instruments are securely attached and no binding or excessive backlash exists in the gears.
- b. The line of sight of the panoramic telescope is parallel to the axis of the bore throughout the limits elevation.
- c. The line of sight of the elbow telescope is parallel to the axis of the bore.
- d. All scales and indexes are at zero.
- e. All bubbles are centered.

Section II. TESTING TARGET METHOD

33. General

The testing target method consists of alining the lines of sight of the tube, the panoramic telescope, and the elbow telescope with the appropriate aiming diagrams on the testing target.

34. Preparations for Boresighting

- a. Emplace the howitzer on level ground.
- b. Place the tube in the center of traverse.
- c. Install the front and rear boresights (par. 31a).
- d. Level the trunnions by using a plumb line or a gunner's quadrant. The plumb line method is preferable, and the procedure is as follows:
 - (1) Prepare a plumb line (par. 31d).
 - (2) Manually traverse the piece until the plumb line is alined with the front and rear boresights.
 - (3) Elevate and depress the tube throughout its limits. The vertical hairline of the front boresight should remain in coincidence with the plumb line.
 - (4) If coincidence is not maintained, raise the appropriate trail.
 - (5) Perform procedures in (3) and (4) above until coincidence is maintained throughout the elevation limits of the tube.
- e. The gunner's quadrant normally will be used to level the trunnions under field conditions when time is critical. The procedure is as follows:

- (1) Use gunner's quadrant that has been checked by the end-for-end test (par. 49).
- (2) Set the index arm and the micrometer scale on the quadrant at zero.
- (3) Place the gunner's quadrant across the machined lower rim of the top carriage hold down clip.
- (4) Raise the low trail until the bubble on the gunner's quadrant is centered.

f. Set the tube at zero elevation by using a gunner's quadrant and applying corrections determined during the end-for-end test.

g. Center the bubbles in the pitch-level vial and the cross-level vial of the panoramic telescope mount.

35. Boresighting Procedures

With the weapon prepared as in paragraph 34, boresight with the testing target as follows:

a. *Testing Target Alinement.* Place the testing target at least 50 to 100 meters in front of the howitzer. Without moving the tube, aline the center aiming diagram on the testing target with the line of sight through the tube. *The testing target then must be made secure.*

- (1) If the trunnions are level, the aiming diagrams on the testing target *must* be vertical to insure that the horizontal center lines on the testing target are level. This can be determined by using a plumb line on the testing target.

- (2) If the trunnions are not level, the testing target must be canted in the same direction as the piece.
- (3) If the tube is not level longitudinally, the face of the target must be tilted accordingly, either forward or backward.
- (4) In all instances the target must be positioned so that it is at right angles with line of sight through the tube and the horizontal centerlines of the aiming diagrams are parallel to the axis of the trunnions.

b. Panoramic Telescope Alinement.

- (1) Set the azimuth scale and micrometer to zero.
- (2) Turn the elevation knob to aline the horizontal line of the reticle with the horizontal line of the left aiming diagram.
- (3) If the vertical line of the reticle does not line up with the vertical line of the aiming diagram, loosen the locking screws on the telescope socket and adjust the tangent screws until the vertical line of the reticle is properly alined. Tighten the locking screws and verify the adjustment.
- (4) Check that—
 - (a) The crosshairs on the muzzle are centered on the center aiming diagram.
 - (b) The telescope mount is level.

c. Elbow Telescope Alinement.

- (1) Rotate the azimuth and elevation knobs to lay the reticle precisely on the right aiming diagram. If the reticle pattern appears tilted in relationship to the target, loosen the leveling clamping screw on the telescope mount and turn the leveling worm until the range lines are parallel to the horizontal center line of the aiming point. Tighten clamping screws and verify adjustment.
- (2) If the boresight cross on the reticle of the telescope is not alined with the aiming diagram, loosen the vertical and lateral clamping screws.
- (3) Sight through the eyepiece.
- (4) Turn the vertical and leveling adjusting worms until the boresight cross is alined with the aiming diagram.
- (5) Tighten the clamping screws and verify the adjustment.

Section III. DISTANT AIMING POINT METHOD

36. General

The distant aiming point method consists of alining the lines of sight of the tube, the panoramic telescope, and the elbow telescope on an aiming point at a distance of at least 3,000 meters.

37. Preparations for Boresighting

a. Select a well-defined point at a distance of not less than 3,000 meters.

b. Preparations prescribed for the testing target method apply, except accurate leveling of the trunnions is not required.

38. Boresighting Procedure

a. Lay the line of sight of the tube on the distant aiming point.

b. Lay the reticle of the panoramic telescope and the elbow telescope on the distant aiming point with the same sight picture observed through the tube.

c. Adjust the telescopes as required (par. 35*b* and *c*).

Section IV. AIMING CIRCLE METHOD

39. General

The aiming circle method of boresighting may be used when weather or terrain prohibits the use of the testing target method or the distant aiming point method. The aiming circle method corrects only deflection errors. It does not include a test for determining elevation errors. When this method is used, any adjustments should be verified at the first opportunity by boresighting on a testing target or a distant aiming point. Before boresighting with the aiming circle, certain preliminary operations (par. 40) must be performed, preferably after a basic periodic test (pars. 45-47) when the panoramic telescope mount is in correct adjustment.

40. Preparations for Boresighting

a. The aiming circle is set up 30 to 50 meters in the rear of the weapon, and a parallax shield (par. 126, TM 9-3004) is fastened to the eyepiece.

b. The trunnions of the weapon are leveled.

c. A common straight pin is fastened in the top witness mark on the muzzle with a piece of adhesive tape so that the pin projects above the muzzle. Threads are then fastened in the witness marks.

d. The breech boresight is placed in the bore so that two of the fingerholes are in a vertical plane.

e. A straightedge is placed in a vertical position on the rear face of the breech, and the left side of the straightedge is alined with the center of

the center hole of the breech boresight and the vertical thread on the muzzle.

f. By sighting through the aiming circle and traversing the tube, the pin mounted on the muzzle and the left side of the straightedge are alined with the right edge of the vertical hairline of the aiming circle. A pencil line is drawn on the breech along the left side of the straightedge.

g. The straightedge is laid on the top of the tube at the muzzle end along the line of sight, and another pencil line is drawn.

h. White stripes are then painted on the top of the tube and on the breech (fig. 10) so that the left edge of the stripes coincides with the pencil lines.

i. During the actual boresighting with the aiming circle, the leveling of the trunnions is not necessary. Therefore, a corresponding boresight mark (radius mark) must be placed on the rear face of the breech. This radius mark is painted on the breech along a line that intersects the vertical line at exactly the same distance from the axis of the bore. The distance is determined by measuring the distance from the center of the crosshairs on the muzzle to the top edge of the muzzle. Then, the same distance is measured from the center of the obturator spindle vent up the vertical line on the breech. Owing to the rounded surface of the breech-block, the horizontal radius mark must be established in the following manner:

- (1) The breech is opened and the tube is depressed until the crosshairs of the aim-

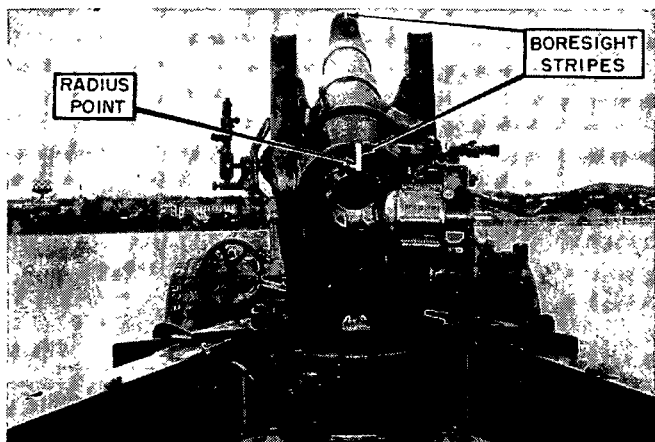


Figure 10. Boresight stripes on muzzle and breech with radius point indicated.

ing circle reticle are centered directly on the muzzle boresight. When breech is closed, the crosshairs of the aiming circle reticle should be centered on the obturator spindle vent.

- (2) The end of the straightedge is placed over the obturator spindle vent with the edge along the vertical line.
- (3) The distance measured at the muzzle is marked on the straightedge.
- (4) The crosshairs of the aiming circle reticle are alined with the distance measured on the straightedge.
- (5) The straightedge is placed in a horizontal position on the breechblock so that the lower edge coincides with the upper edge of the horizontal crosshair of the aiming circle reticle. A pencil line is drawn along the lower edge of the straightedge. The radius mark is painted along the pencil line so that it intersects the vertical boresight mark (fig. 11).

41. Boresighting Procedure

a. The aiming circle is set up 30 to 50 meters in the rear of the weapon.

b. A parallax shield is placed over the eyepiece of the panoramic telescope and the eyepiece of the aiming circle.

c. The scales of the aiming circle are set at zero.

d. By traversing the weapon and using the lower motion of the aiming circle, the right edge of the

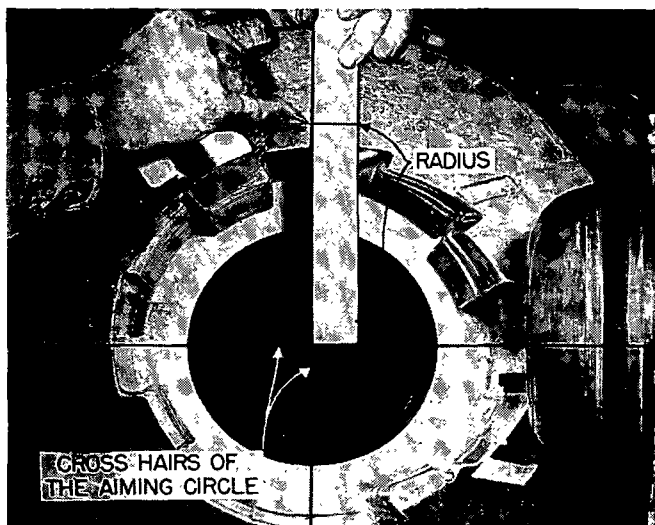


Figure 11. Establishing the radius point.

vertical hair in the reticle is alined on the intersection of the radius mark with the vertical boresight mark on the breech and alined on the top left edge of the boresight mark (fig. 12) on the muzzle. The line of sight must be exactly on these two points when the trunnions are not level so that sighting is on a horizontal plane.

e. The azimuth micrometer knob is used to sight on the objective lens of the panoramic telescope. The amount of the angle measured is called to the operator of the panoramic telescope.

f. The operator of the panoramic telescope places this angle on the scales of the telescope and, by means of the tangent screws, alines the line of sight of the telescope on the objective lens of the aiming circle.

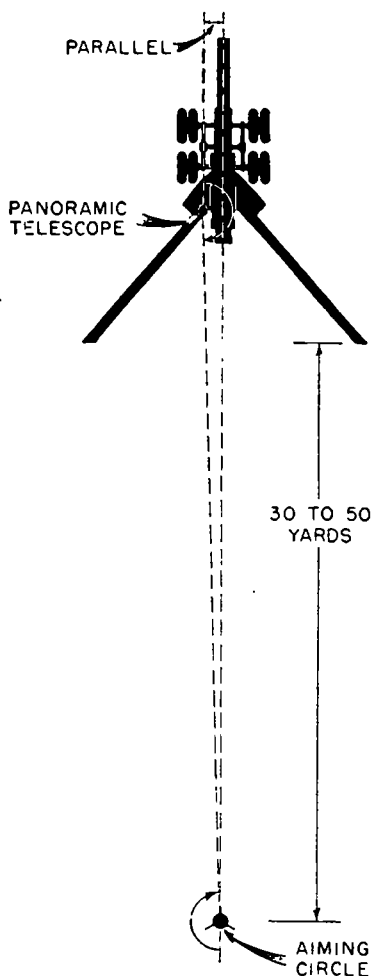


Figure 12. Measuring the boresighting angle with the aiming circle and panoramic telescope.

Section V. STANDARD ANGLE METHOD

42. General

The standard angle method of boresighting consists of referring the line of sight of the panoramic telescope to a selected point on the muzzle, using standard angles in azimuth and elevation. This method of boresighting normally will be used when it is not practical to use the methods previously discussed. Misalignment corrections determined from this test should be verified as soon as possible by a more accurate means of boresighting.

43. Preparations for Boresighting

The ideal time to determine standard angles is immediately after the basic periodic tests have been performed. The procedure is as follows:

- a. Verify that the trunnions are level.
- b. Verify that the panoramic telescope mount is level.
- c. Verify that the recoiling parts are in the correct position with respect to the nonrecoiling parts by checking that the breech ring is snug against the cradle housing.
- d. Boresight the weapon by using the testing target method (pars. 34 and 35).
- e. Fasten a small pin, approximately $\frac{1}{32}$ -inch diameter, in the left horizontal witness mark of the muzzle. The pin must extend past the muzzle and be visible through the panoramic telescope.
- f. Fasten a parallax shield over the eyepiece of the panoramic telescope.

g. Elevate and depress the tube until the horizontal hairline of the panoramic telescope is alined with the pin in the witness mark.

h. Turn the azimuth micrometer knob until the vertical hairline of the panoramic telescope is alined at the junction of the pin and the muzzle (fig. 13).

i. With a sharp instrument scribe a line in the paint on the body of the telescope mount and fill the scribed line with red paint.

j. Read and record the deflection from the panoramic telescope to the nearest $\frac{1}{4}$ -mil. *This deflection is the standard azimuth angle* (fig. 14).

k. Using the gunner's quadrant, read and record the elevation angle to the nearest $\frac{1}{4}$ mil. *This angle is the standard angle* (fig. 15).

l. If the tube or carriage is changed, the standard angles must be reestablished.

44. Boresighting Procedure

After the standard angles have been determined, the procedure for boresighting is as follows:

a. Verify that the breech ring is snug against the cradle housing.

b. Fasten a pin in the left horizontal witness mark.

c. Place a parallax shield on telescope eyepiece.

d. Set off the standard azimuth and elevation angles.

e. Verify that the red scribed line is in coincidence.

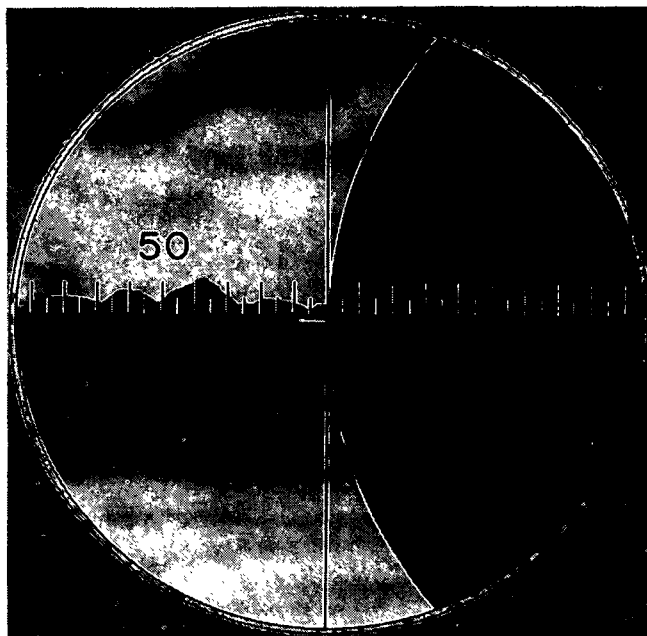


Figure 13. Sight picture, standard angle.

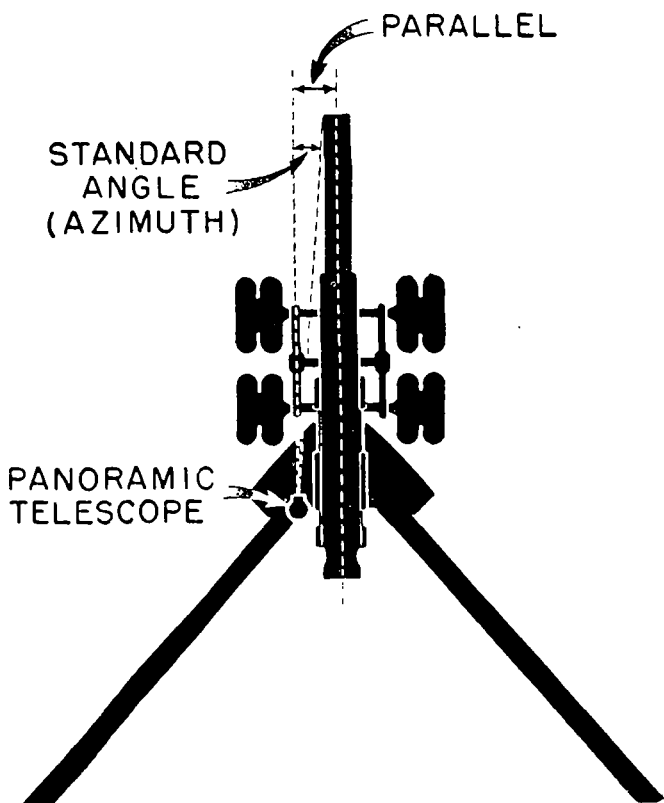


Figure 14. Standard angle (azimuth)

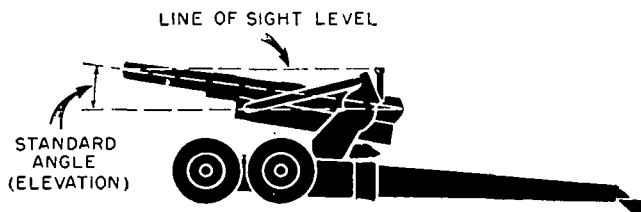


Figure 15. Standard angle (elevation).

f. If the vertical line of the reticle is not in exact alinement, adjust the tangent screws until the vertical line of the reticle is properly alined.

g. If the horizontal line of the reticle is not in exact alinement, turn the elevation knob of the panoramic telescope until the reticle is properly alined to match the fine elevation indexes (par. 35*b*).

CHAPTER 6

BASIC PERIODIC TESTS

Section I. GENERAL

45. Purpose

Basic periodic tests are performed—

a. To reveal whether the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

b. By the section and the artillery mechanic under the supervision of the battery executive.

c. At the discretion of the unit commander. Suggested times are—

- (1) Once each year if the howitzer is used for nonfiring training.
- (2) Every 3 months if the howitzer is fired.
- (3) As soon as possible after intensive use, accidents, or travel in extremely rough terrain.
- (4) When fire is inaccurate for no apparent reason.

46. Preparations for Basic Periodic Tests

The following conditions must be established prior to conducting the basic periodic tests:

a. Place the howitzer on a site that is as nearly level as possible.

b. Suspend a plumb line (par. 31d).

c. Level the trunnions.

d. Boresight the howitzer using the testing target method.

e. Prepare a parallax shield for the panoramic telescope to eliminate parallax when the plumb line is viewed at close range.

47. Conditions

Care must be taken to insure that the following conditions exist:

a. The line of sight of the panoramic telescope remains in a plane parallel to the vertical plane passing through the axis of the bore as the weapon is elevated throughout its limits of elevation.

b. With the sight mount longitudinal-level bubble centered, the cross-level bubble remains centered throughout the limits of elevation of the tube.

c. With the tube level, the sight mount longitudinal-level bubble remains centered when the movable cross-level segment is operated throughout its limits.

d. With the gunner's quadrant set at zero and allowable corrections applied, the quadrant bubble centers when the tube is level.

Section II. TESTS OF GUNNER'S QUADRANT AND MOUNT

48. General

The gunner's quadrant *must* be in proper adjustment *prior* to conducting tests and adjustments on other sighting and fire control equipment.

49. End-for-End Test

a. Inspect the shoes on the gunner's quadrant for dirt, nicks, and burs.

b. Inspect the quadrant seats on the breech for dirt, nicks, and burs.

c. Zero the scales on the gunner's quadrant.

d. Place the quadrant on the quadrant seats, and depress or elevate the tube until the bubble in the gunner's quadrant is centered.

e. Reverse the quadrant on the seats and check the bubble; if the bubble recenters, the quadrant is in adjustment, and the test is completed.

f. If the bubble does not center, turn the micrometer knob and try to center the bubble.

(1) If the bubble centers, read the black figures on the micrometer scale and divide by 2. *The quotient is the correction for the gunner's quadrant.*

(2) Place the correction on the micrometer scale, and level the tube.

(3) Reverse the quadrant. The bubbles should center.

g. If the bubble does not center as in f above,

move the gunner's quadrant arm down one graduation (10 mils).

- (1) Turn the micrometer knob until the bubble centers.
- (2) Take the reading on the micrometer scale, add 10 to it, and divide the sum by 2. Place the value of the quotient on the micrometer scale.
- (3) With the quadrant arm set at minus 10 and the value obtained in (2) above set on the micrometer scale, place the quadrant on the quadrant seats and level the tube.
- (4) Reverse the quadrant. The bubbles should center.
- (5) Subtract the reading on the micrometer scale from 10 to obtain the error.

Note. If the error determined exceeds 0.4 mil, the quadrant must be sent to ordnance. If an error has been determined during the end-for-end test, it will be used only during sighting tests and adjustments and not carried in fire missions.

50. Micrometer Test

a. Set the radial arm to a reading of 10 mils on the elevation scale and set the micrometer at zero.

b. Place the quadrant on the leveling plates with the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.

c. Set the radial arm at zero and set the micrometer at 10 mils.

d. Reverse the quadrant; the bubbles should center.

Note. Do not disturb the lay of the tube.

e. If the bubble does not center, the *micrometer* is in error and must be adjusted by ordnance.

51. Comparison Test

The comparison test is conducted in the following manner:

a. Compare the readings taken at low, medium, and high elevations with each gunner's quadrant in the battery on the leveling plates of a single piece.

b. Compute the average reading at each elevation.

c. Compare each quadrant reading with the average reading.

d. Any quadrant differing more than 0.4 mil from the average reading must be adjusted by ordnance.

e. When a gunner's quadrant requires a correction as determined by the end-for-end test, this correction is not carried during firing but is recorded and applied only when sight tests and adjustments are made.

Section III. TESTS OF ON-CARRIAGE FIRE CONTROL EQUIPMENT

52. Telescope Mounts

For tests and adjustments of the panoramic telescope mount and the elbow telescope mount see TM 9-3004, operator's manual.

53. Quadrant Mount

For tests and adjustments of the quadrant mount, see TM 9-3004, operator's manual.

Section IV. TEST OF FUZE SETTERS

54. General

- a. Examine for burred or dented edges—
 - (1) The stop that fits into the slot of the movable time ring.
 - (2) The adjusting pawl which engages the notch in the fixed fuze ring.
- b. Depress the adjustable pawl against its spring to determine that the pawl has free movement.
- c. Test the fuze setter with the fuze for which it is designed; the time scale on the fuze setter must have the same graduations as the time ring on the fuze.

55. Time Scale Test

- a. Set the corrector to 30.
- b. Set any convenient time on the time scale.
- c. Test the time scale on the fuze setter by setting several fuzes.
 - (1) The time set on the fuze should agree with the time setting on the fuze setter within one-fourth of the smallest graduation on the fuze time ring.

Caution: Before setting a fuze, make sure that the T and C screws (of the fuze setter) are tight so that the scale indexes will not slip when the handle is rotated.
 - (2) Tolerances :
 - (a) 0.05 second for fuzes with 0.2-second graduations.

- (b) 0.125 second for fuzes with 0.5-second graduations.
- (3) If the fuzes do not agree with the time set on the fuze setter—
 - (a) Repeat the test as a check with a different setting.
 - (b) If the fuzes and the fuze setter still do not agree refer the instrument to ordnance.
- (4) Do not set a live fuze more than twice.
- (5) Never use a fuze from a dud.
- (6) When tests are complete, reset all fuzes to SAFE and replace the safety wire or cotter pin.

CHAPTER 7

MAINTENANCE AND INSPECTIONS

56. General

Systematic maintenance and inspection are essential to insure that—

a. The howitzer section is prepared to perform its mission immediately.

b. Unexpected breakdowns are not experienced at a critical time when maximum performance is essential.

c. Expensive and time-consuming repairs are reduced to a minimum.

57. Disassembly, Adjustment, and Assembly

Authorized adjustments and disassemblies to be performed by battery personnel are prescribed in TM 9-3004, operator's manual, and appropriate Department of the Army supply manuals. Deviation from these procedures is not authorized, except as permitted by the responsible ordnance officer.

58. Records

The principal records pertaining to the weapon are the Equipment Log Book and DA Form 2407 (Maintenance Request). For detailed information on the use of these forms, see TM 38-750.

59. Maintenance

Detailed instructions for maintaining the howitz-

er and the carriage are contained in TM 9-3004, operator's manual, and LO 9-335.

60. Inspections, General

a. *The chief of section* should inspect his equipment *daily* and take immediate action to correct any deficiencies found.

b. *The executive*, accompanied by the artillery mechanic should make *daily informal command inspections* on different parts of the weapon and carriage.

c. *The executive* should make a thorough mechanical inspection *at least once a month* of the weapons, auxiliary equipment, tools, and spare parts.

d. Detailed instructions for inspecting the howitzer M2 are contained in TM 9-3004, operator's manual.

e. For detailed instructions for inspecting the prime mover being used, see the appropriate technical manual for that vehicle.

61. Operational Services

A daily service is performed by the driver and the crew *each day* the vehicle is operated. This service is divided into three phases.

a. *Before-Operation Service* is a brief service to determine whether the vehicle and howitzer are ready for operation. At this time the chief of section will verify that sufficient ammunition, tools, and equipment are available and secure.

b. *During-Operation Service* consists of detecting any unsatisfactory performance of the vehicle.

c. *After-Operation Service* prepares the vehicle to operate again on a moment's notice. This is the basic daily service for the vehicle, and it is particularly important to detect deficiencies that developed during operation. All defects that the driver and crew cannot remedy must be reported at this time. The chief of section will resupply ammunition as required and verify that all equipment is present. Procedures for daily preventive maintenance services are contained in TM 9-3004, operator's manual, and the appropriate technical manual for the prime mover.

CHAPTER 8

DECONTAMINATION OF EQUIPMENT

62. General

a. Equipment that has been contaminated with chemical, biological, or radiological agents constitutes a hazard to personnel and must be removed or neutralized.

b. Decontamination is the process of covering, removing, destroying, or changing into harmless substances the contaminating agent or agents.

c. Decontamination must be started as soon as possible in order to reduce hazards and to allow safe operation of equipment.

63. Decontamination of Toxic Chemical Agents

Table VIII prescribes the actions and the decontaminants to be used for toxic chemical agents.

64. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents.

65. Decontamination of Radiological Agents

a. *Radioactive contaminants* cannot be made safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay.

b. *Decontamination* is the process of *reducing* the hazard by removing or shielding against radiation. Methods are contained in table IX.

Table VIII. Decontamination for Toxic Chemical Agents

Contaminated object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Canvas	Boil in soapy water for 1 hour. Use 5 percent solution of household bleach for V-agents. Use 5 percent solution of washing soda for G-agents.	Immerse in boiling water for 1 hour. Launder by standard methods. Use DANC ¹ solution or DS2 ¹ . Use slurry ² .	Aerate (except for V-agents).
Clothing	Immerse in boiling water for 1 hour, stir, add 1 pound of soap to each 10 gallons of water. 5 percent solution of bleach for V-agents. 5 percent solution of washing soda for G-agents.	Launder by standard methods. Dryclean. Use DS2 for cotton items only.	Rub M5 ointment on small contaminated areas. Aerate except for V-agents.

¹ DANC and DS2 are injurious to plastic and hard rubber and should not be used in the bore.

² Equal weights of water and chloride of lime.

Table VIII. Decontamination for Toxic Chemical Agents—Continued

Contaminated object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Unpainted metals.	Use DS2 or DANC; then rinse or wipe with organic solvent ³ and dry.	Wash with <i>cool</i> soapy water ³ and rinse.	Aerate.
Painted metals.	Spray with DS2 or DANC solution.	Wash with hot, soapy water and rinse. (Slurry may be used if it is removed within 1 hour and the surface is oiled.)	Aerate. Weather.
Instruments..	Clean with alcohol (or gasoline) and apply a thin coat of oil.	Wipe with rag dampened with DANC or DS2, dry with clean rag, and oil.	Weather.

³ Organic solvents (petroleum products) and water do not neutralize contaminants. Precautions must be taken to dispose of the solvents as contaminated material.

Table IX. Decontamination for Radiological Agents

Method	Contaminated object	Technique	Remarks
Water washing scrubbing.	All nonporous surfaces (metal, paint, plastics).	Work from top to bottom and up wind.	Drainage must be controlled—water is contaminated.
Detergent (soap) solution.	All nonporous surfaces.	Heat water if possible. Rub surface and wipe dry. (Moist application is all that is desired; do not let drip.)	Rags and runoff require disposal.
Organic solvents. (Petroleum products.)	All nonporous surfaces.	Immerse or wash with solvent, then wash in hot, soapy water and rinse with clear water.	Vapors are toxic; fire precautions are required.
Brushing	Porous and nonporous surfaces.	Brush or sweep dust from equipment or clothing.	Limited control of contaminated dust. Wear protective mask.
Sanding, filing, or grinding may be used to reduce hot spots. These methods are not practicable for large areas. Protective mask and gloves are required.			
Laundry	Clothing	Use hot, soapy water and rinse with clear water.	Water requires disposal.
Bathing and scrubbing.	Personnel	Use brushes, running water, and soap.	Continue scrubbing until contamination level is safe.

CHAPTER 9

DESTRUCTION OF EQUIPMENT

66. General

a. Tactical situation may arise in which it is necessary to abandon equipment in the combat zone. In such situations all equipment must be destroyed to prevent its use by the enemy.

b. Equipment will be destroyed only on the authority delegated by a division or higher commander.

67. Plans

A plan will be prepared by each battery to expedite destruction of equipment. The principles are as follows:

a. Plans must be adequate, uniform, and easily executed.

b. Essential parts must be destroyed first.

c. Destruction must be as complete as possible.

d. Spare parts and accessories must be given the same priority as those installed on equipment.

68. Methods

a. The most generally applicable methods of destruction are:

(1) *Mechanical*—Requires ax, pick, sledge, or similar equipment.

(2) *Burning*—Requires gasoline, oil, or other flammables.

(3) *Demolition*—Requires ammunition or explosives.

(4) *Gunfire*—Requires artillery, rocket launchers, rifle grenades, or hand grenades.

b. In general, destruction of essential parts followed by burning is sufficient to render a weapon useless.

69. References

Detailed information on destruction of the howitzer is contained in TM 9-3004, operator's manual; for ammunition, see TM 9-1901, technical manuals listed in paragraph 28*h*, and the appropriate technical manual for the prime mover.

CHAPTER 10

SAFETY PRECAUTIONS

70. General

Safety precautions to be observed in training are prescribed in AR 385-63. Additional information is found in FM 6-40, FM 6-140, TM 9-3004, and TM 9-1900. The more important safety precautions are summarized in paragraphs 71 through 73.

71. Ammunition

The following precautions must be observed when handling ammunition:

- a.* Store ammunition in the firing position so that it is protected against accidental explosions.
- b.* Keep fire and flammables out of the area.
- c.* Protect ammunition from direct rays of the sun.
- d.* Do not disassemble fuzes.
- e.* All ammunition prepared for firing and not fired must be checked to insure that —
 - (1) Powder increments are in proper order, in good condition, of the proper lot number, and placed in containers marked with corresponding lot number.
 - (2) Time fuzes are reset to SAFE and the safety wires are replaced.

72. Failure to Fire

If the weapon fails to fire —

a. Make two additional attempts to fire the weapon.

b. Keep the weapon trained on the target.

c. Clear unnecessary personnel from the vicinity of the howitzer.

d. Wait 2 minutes after the last attempt to fire.

e. Remove primer, staying out of the path of recoil.

f. Inspect primer. If the primer has not been indented by the firing pin, inspect the firing pin.

g. If the primer is indented, replace with a new primer and fire the weapon.

h. If the primer did fire, wait an additional 8 minutes from the last attempt before opening the breech (a total of 10 minutes).

73. Drill and Firing

a. The weapon is loaded only when firing is imminent.

b. Personnel should move in rear of the piece when going from side to side.

c. Personnel must stay clear of recoil path.

d. Crew members should use ear plugs or cotton to protect ear drums.

e. A safety officer will be present during all firing in training exercises. Specific duties for the safety officer are listed in FM 6-40.

CHAPTER 11

TRAINING

Section 1. GENERAL

74. Purpose

The purpose of this chapter is to present the minimum requirements for training the howitzer section. Included are —

- a. Information for conduct of training.
- b. Minimum training schedule.
- c. Gunner's qualification tests.

75. Conduct of Training

Section training is *conducted* by the section chief. Battery officers are responsible for preparing training plans and supervising their execution. The chief of section will —

a. Train *each* member of his section to function smoothly and efficiently in *all duties* within the section.

b. Weld the section into an effective, coordinated team, capable of functioning efficiently in combat.

c. Emphasize the application of prior instruction to current training.

d. Maintain a progress card on each man to show —

- (1) Instruction attended.
- (2) Tests taken.
- (3) Remarks pertaining to progress.

e. References: AR 611-201, ATP 6-100, FM 21-5, and FM 6-125.

Section II. MINIMUM TRAINING SCHEDULE

76. Training Periods

The following principles should be followed in scheduling and preparing training periods:

a. Periods in service of the piece drill should be arranged along with other battery training to provide a balanced training program.

b. Section drill should not exceed 1 hour and should be conducted in a vigorous manner.

c. Howitzer drill should be preceded and followed with logically related subjects. For example, precede the drill period with tests and adjustments and follow the period with inspection and maintenance.

d. Army Subject Schedule 6-3 provides uniform guidance for cannoneer training.

e. Operational and maintenance characteristics of the weapon are referenced in TM 9-3004.

f. The training schedule outlined in paragraph 77 is a guide to meet the minimum training requirements.

77. Schedule

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW.....	1	Organization and composition of howitzer section, general duties of individuals, and formation of howitzer section.	Pars. 2, 3, 8, and 15.	Howitzer and vehicle.
C, D, PW.....	1	Posts and posting, changing posts, and mounting and dismounting.	Pars. 8-14	Do.
C, D, PW.....	2 (1-hour periods.)	Prepare for action. March order.....	Pars. 17, 23..	Do.
C, D, PW.....	24 (½-hour periods.)	Howitzer drill, duties in firing by indirect laying.	Par. 18	TOE equipment.
C, D, PW.....	9 (½-hour periods.)	Howitzer drill, duties in firing by direct laying.	Pars. 19-22....	Do.

C, D, PW.....	6 (1-hour and ½- hour periods.)	Tests and adjustments of sighting and fire control equipment.	Pars. 29-55....	Do.
C, D, PW.....	2 (½-hour periods.)	Aiming post displacement correction....	Table III.....	TOE equipment, blackboard and chalk.
C, D, PW.....	4 (1-hour periods.)	Inspection and maintenance drills.....	Pars. 56-61....	TOE equipment.
C, D, PW.....	1	Decontamination of equipment.....	Pars. 62-65....	Decontamination and TOE equipment.
C, D, PW.....	1	Destruction of equipment to prevent use by the enemy.	Pars. 66-69....	Demolition and TOE equipment.
C, D.....	1	Safety precautions	Pars. 70-73....	TOE equipment.

Method	Hours	Subject	Text references	Training aids and equipment
PW.....	16 (4-hour periods.)	Service practice, firing by indirect laying.	Par. 18.....	Do.
PW.....	4	Service practice, firing by direct laying.	Pars. 19-22....	Do.
C, PW.....	6 (1-hour periods.)	Review and tests of subjects previously covered.	All previous references.	Do.

C—conference, D—demonstration, PW—practical work.

Section III. GUNNER'S QUALIFICATION TESTS

78. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purpose of the tests is to —

a. Determine the relative proficiency of the *artillery soldier* while performing the duties of gunner, 8-inch howitzer M2, towed. *The tests are not a basis for determining the relative proficiency of batteries or higher units.*

b. Serve as an adjunct to training.

79. General Instructions, Standards of Precision

The following standards are required for the candidate:

a. Scale settings must be exact.

b. Leveling bubbles must be centered *exactly*.

c. The vertical hairline in the panoramic telescope must be alined on the left edge of the aiming post or on the same part of the aiming point or target each time the howitzer is laid.

d. *Final motions* must be made in the appropriate directions.

(1) The scales are set from lower to higher numbers.

(2) The tube is *elevated* in the direction of more difficult movement.

(3) The tube is *traversed* from left to right.

(4) The *vertical hairline* of the panoramic telescope is alined on the aiming point from left to right.

80. Assistance

a. The candidate will receive no unauthorized assistance.

b. The candidate may select assistants as authorized in the tests.

c. If an assistant or the examiner causes the candidate to fail a test, the test will be disregarded and another test of the same nature will be administered.

81. Time

a. The time allowed for each test is the time from the last word of the command to the last word of the candidate's report.

b. The candidate may begin a test after the first word of the first command.

82. Scoring

a. Scoring will be in accordance with the subparagraphs entitled "Penalties" and "Credit."

b. No penalty will be assessed in excess of the maximum credit allowed for each test.

83. Preparation for Tests

a. The howitzer will be prepared for action and the candidate will be posted in the position corresponding to the test or as indicated in the subparagraph entitled "Special Instructions."

b. The examiner will insure that the candidate understands the requirements of the test.

c. The candidate will report "I am ready" before each test.

84. Qualification Scores

Minimum scores required for qualification in the courses are as follows:

<i>Individual classification</i>	<i>Points</i>
Expert gunner	90
First-class gunner	80
Second-class gunner	70

85. Outline of Tests.

Paragraph	Subject	Number of tests	Points each	Maximum credit
86	Direct laying, panoramic telescope	4	3	12
87	Direct laying, elbow telescope	4	1	4
88	Indirect laying, deflection only	16	2	32
89	Laying for elevation with gunner's quadrant.....	3	2	6
90	Cross-leveling the quadrant mount and operat- ing the elevation mechanism clutch lever.	3	2	6
91	Displacement correction	1		5
	Part I		4	(4)
	Part II		1	(1)
92	Measuring site to the mask	1	5	5
93	Referring the howitzer	1	5	5
94	Tests and adjustments of sighting and fire control equipment.	6		10
	Test 1	(1)	2	(2)
	Tests 2, 3, 5, and 6	(4)	1	(4)
	Test 4	(1)	4	(4)
95	Materiel	3	5	15
Total Credit				100

86. Direct Laying, Panoramic Telescope

a. Scope of Tests.

- (1) Four tests (two groups of two tests each) will be conducted in which the candidate will be required to execute commands similar to those in *c* below.
- (2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.
- (3) The candidate will be tested in the duties of the gunner.

b. Special Instructions.

- (1) A stationary target will be placed approximately 600 meters from the howitzer.
- (2) The fixed azimuth scale and the azimuth micrometer scale will be set at zero.
- (3) The candidate will be posted as the gunner.
- (4) The howitzer will be pointed so that —
 - (a) A shift of approximately 100 mils will be required for tests 1 and 3.
 - (b) It will not be necessary to shift the trails for any of the four tests.
- (5) The laying of the piece will not be disturbed after tests 1 and 3.
- (6) The examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite that in test 1.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK: LEAD 5, RANGE 600.	Centers cross-level bubble. Traverses howitzer until proper lead has been set. (The horizontal crosshair of the reticle should be placed on the target in order to insure accuracy of lead.) When ready, steps clear and commands FIRE.
2 and 4.	RIGHT (LEFT) (10), ADD (DROP) 200.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test —

- (1) The azimuth scale has been moved from zero.
- (2) The indexes on the azimuth micrometer have been moved from zero.
- (3) The lead in mils is not set properly.
- (4) The cross-level bubble was not centered prior to traversing the howitzer.

e. Credit.

Time in seconds, exactly or

less than 7 8 9

Credit (points for each test).. 3.0 2.0 1.0

87. Direct Laying, Elbow Telescope

a. Scope of Tests.

- (1) Four tests (two groups of two tests each) will be conducted in which the

candidate will be required to execute commands similar to those in *c* below.

- (2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.
- (3) The candidate will be tested in the duties of the assistant gunner, laying for range by using the elbow telescope.

b. Special Instructions.

- (1) A stationary target will be placed approximately 600 meters from the howitzer.
- (2) For tests 1 and 3, the field of view of the telescope will be placed on the target with the correct range line more than 100 meters off the target.
- (3) An assistant selected by the candidate will be posted as number 2 cannoneer to release and lock the elevating mechanism by operating the clutch lever.
- (4) The laying of the howitzer will not be disturbed after tests 1 and 3.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK: RANGE 500.	Places proper reticle line for announced range on the center of the visible mass of the target. Calls "Set" and steps clear.
2 and 4.	ADD (DROP) 100.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test, the correct range line is not on the center of the visible mass of the target.

e. Credit.

Time in seconds, exactly or

less than $1\frac{2}{5}$ $1\frac{4}{5}$ 2

Credit (points for

each test) 1.0 0.7 0.5

88. Indirect Laying, Deflection Only

a. Scope of Tests. Sixteen tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below. Tests 1 through 8 (and tests 9-16) will be executed as one series of commands.

b. Special Instructions.

- (1) Commands will not necessitate shifting trails.
- (2) The examiner will select a suitable aiming point and identify it to the candidate.
- (3) The commands for new deflections for the following tests will be within the limits prescribed below:

Test number	Maximum change (mils)	Minimum change (mils)
2 and 10	180	140
3 and 11	90	70
7 and 15	100	60
8 and 16	50	30

- (4) The howitzer will be laid with correct settings at the conclusion of each test before the examining proceeds with the next test.

- (5) Aiming posts will be set out at the prescribed deflection and distance for these tests.
- (6) The examiner will designate the section number of the howitzer to be used.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 9.	DEFLECTION 2690.	Sets deflection. Centers the cross- and longitudinal-level bubbles. Traverses the tube until the vertical hairline of the panoramic telescope reticle is on the left edge of the aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 10.	DEFLECTION 2550.	Sets deflection. Lays on aiming posts. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
3 and 11.	DEFLECTION 2620. At conclusion of tests 3 and 11, give CEASE FIRE, END OF MISSION. (No time considered for this operation.)	Same as test 2 above.

Test number	Examiner commands (for example)	Action of candidate
4 and 12.	AIMING POINT, CHURCH STEEPLE, REFER.	Refers telescope to church steeple. Reads deflection and calls "Number 1, deflection (so much)."
5 and 13.	DEFLECTION 2600, REFER.	Slips the slipping micrometer scale to zero. Slips the slipping azimuth scale to 2600. Verifies that the vertical hairline of the reticle is on the church steeple. Calls "Number 1, deflection 2600." Steps clear.
6 and 14.	DEFLECTION. 2680.	Same as test 1 above.
7 and 15.	DEFLECTION 2730.	Same as test 2 above.
8 and 16.	DEFLECTION 2750.	Same as test 2 above.

d. Penalties.

(1) No credit will be allowed if, after each test —

- (a) The deflection is set incorrectly.
- (b) The cross-level or longitudinal-level bubble is not centered.
- (c) The vertical hairline of the telescope is not on the aiming point or left

edge of the aiming posts, as the case may be.

- (2) The last motion of the traverse was not made to the right.

e. Credit.

Time in seconds:

For tests 1 and 9 and tests			
5 and 13, each.....	14	15 $\frac{2}{5}$	16
For other tests, each ex-			
actly or less than....	11	12	13
Credit (points for			
each test)	2.0	1.5	1.0

89. Laying for Elevation with Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below.

b. Special Instructions.

- (1) Each test will require a change of quadrant elevation setting within the limits of 30 to 60 mils.
- (2) An assistant selected by the candidate will be posted as number 2 cannoneer to release and lock the elevating mechanism by operating the clutch lever and to cross-level the quadrant mount, when necessary.
- (3) Before beginning the first test, the gunner's quadrant will be set at zero and the cross-level bubble of the quadrant mount will be centered.
- (4) The candidate will be posted as the assistant gunner.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1	QUADRANT 180..	Sets gunner's quadrant at 180, seats gunner's quadrant, elevates or depresses the tube until the quadrant bubble is centered. Verifies centering of cross-level bubble. Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 240..	Same as test 1 above.
3	QUADRANT 205..	Same as test 1 above.

d. Penalties.

- (1) No credit will be allowed if, after each test—
 - (a) The quadrant elevation is set incorrectly.
 - (b) The quadrant is not properly seated.
 - (c) The quadrant bubble is not properly centered.
- (2) No credit will be allowed if the last movement of the tube was not in the direction in which the elevating handwheel is more difficult to turn.

e. Credit.

Time in seconds, exactly
or less than

9 10 11

Credit (points for

each test) 2.0 1.5 1.0

90. Cross-Leveling Quadrant Mount and Operating Elevation Mechanism Clutch Lever

a. Scope of Tests. Three tests will be conducted in which the candidates will be required to execute commands similar to those in *c* below.

b. Special Instructions.

- (1) The quadrant mount cross-level bubble will not be level for the first test.
- (2) Each succeeding test will require a change of quadrant elevation setting within the limits of 50 to 75 mils. An assistant selected by the candidate will be posted as the assistant gunner to operate the elevating handwheel and to set and level the gunner's quadrant.
- (3) The candidate will take the post of number 2 cannoneer.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1	QUADRANT 180..	Centers quadrant mount cross-level bubble. Releases elevation mechanism clutch lever. Sets elevation mechanism clutch lever when directed by the assistant gunner. Rechecks the cross-level bubble.
2	QUADRANT 240..	Same as test 1 above.
3	QUADRANT 187..	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test —

- (1) The quadrant mount cross-level bubble is not centered.
- (2) The elevating mechanism clutch lever is not applied promptly and smoothly.
- (3) The candidate fails to center the cross-level bubble before changing elevation and fails to check the cross-level bubble after changing elevation.

e. Credit.

Time in seconds, exactly

or less than	5	5 $\frac{3}{5}$	6
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Credit (points for

each test)	2.0	1.5	1.0
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91. Displacement Correction

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands in *c* below.

b. Special Instructions.

- (1) Aiming posts will be set out at the prescribed distances.
- (2) An assistant, selected by the candidate, will be stationed close to the far aiming post.
- (3) The examiner will require the candidate to lay the howitzer on an announced deflection and report "I am ready."
- (4) Then the far post will be moved so that a displacement of 5 to 10 mils occurs.

- (5) The laying of the howitzer at the termination of part I will not be disturbed for part II.

c. Outline of Tests.

(1) *Part I.*

Examiner commands	Action for candidate
CORRECT FOR DISPLACEMENT.	Lays the howitzer so that the far aiming post appears midway between the near post and the vertical hairline of the telescope reticle. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

(2) *Part II.*

Examiner commands	Action of candidate
ALINE AIMING POSTS.	Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties.

- (1) *Part I.* No credit will be allowed if —

- The far aiming post does not appear midway between the near post and the vertical hairline of the telescope.
- The cross-level or the longitudinal-level bubble is not centered.
- The last motion of traverse was not made to the right.

- (2) *Part II.* No credit will be allowed if —
- (a) The deflection is other than the announced deflection.
 - (b) The aiming posts are not properly alined.
 - (c) The vertical line of the telescope is not on the left edge of the aiming posts.

e. Credit.

Part I, time in seconds,

exactly or less than.	7	8	9	10
Credit	4.0	3.0	2.0	1.0
Part II, no time limit..	—	—	—	—
Credit	1.0	—	—	—

92. Measuring Site to Mask

a. Scope of Test. One test will be conducted in which the candidate will be posted as chief of section and will execute the command in *c* below.

b. Special Instructions.

- (1) The howitzer, prepared for action, will be placed 200 to 400 meters from a mask of reasonable height.
- (2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils to the right or left of the highest point of the crest.
- (3) The candidate will be posted at the right rear of the breech.
- (4) Three assistants, selected by the candidate, will be posted to perform the duties of the gunner, assistant gunner, and number 2.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	Sights along lowest element of bore and directs the gunner, assistant gunner, and number 2 in operation of the elevating and traversing mechanisms until the line of sight just clears the crest. Directs the assistant gunner and number 2 to measure the elevation. Verifies the reading on the gunner's quadrant and reports "Number (so-and-so), site to mask (so much)."

d. Penalties. No credit will be allowed if —

- (1) The line of sight along the lowest element of the bore does not just clear crest.
- (2) The quadrant cross-level bubble is not properly centered.
- (3) The quadrant bubble is not centered when the quadrant is seated properly.
- (4) The site is announced incorrectly.

e. Credit.

Time in seconds, exactly

or less than. 17 18 19 20

Credit 5.0 4.0 3.0 2.5

93. Referring the Howitzer

a. Scope of Test. One test will be conducted in which the candidate will be posted as the gunner

and will measure and report a deflection in accordance with the command in *c* below.

b. Special Instructions.

- (1) The howitzer will be laid on aiming posts to the left front.
- (2) An aiming point within 200 mils to the left or right of the aiming posts will be designated by the examiner and identified by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
NUMBER (so-and-so), AIMING POINT THAT (so-and-so), REFER.	Centers cross-level and longitudinal-level bubbles. Refers to aiming point. Check centering of bubbles and re-lays telescope if necessary. Reads the deflection and reports "Number (so-and-so), deflection (so much)" and steps clear.

d. Penalties. No credit will be allowed if —

- (1) The cross-level or the longitudinal-level bubble is not centered properly.
- (2) The vertical line of the telescope reticle is not on the aiming point.
- (3) The deflection is announced incorrectly.
- (4) The traversing handwheel is turned.

e. Credit.

Time in seconds, exactly

or less than.

	5	5 $\frac{3}{5}$	6	6 $\frac{3}{5}$
Credit	5.0	4.0	3.0	2.5

94. Tests and Adjustments of Sighting and Fire Control Equipment

a. *Scope of Tests.* Six tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments or describe the action taken (i. e., send to the ordnance maintenance company) if adjustment is not authorized by using personnel.

b. *Special Instructions.*

- (1) The howitzer will be prepared for the tests as indicated for the testing target method of boresighting in paragraph 34. Trunnions will be level.
- (2) The equipment for the tests includes boresight, plumb bob, testing target, plumb line, and other section equipment.
- (3) The candidate will select assistants who will operate the elevating mechanism at his direction during tests 1, 2, 3, and 6 and who will adjust and aline the testing target at his direction prior to test 4.
- (4) The tests will be conducted in the sequence indicated in c below. After completion of test 1, the gunner's quadrant used in that test will be used for tests 2, 3, 4, and 6, with the proper correction (determined in test 1) carried on the quadrant, provided the correction does not exceed 0.4 mil.

(5) Adjustments which the candidate may be required to accomplish fall within the following limits:

- (a) Rotating head coarse elevation index — none.
- (b) Rotating head fine elevation index— not to exceed one-fourth turn.
- (c) Panoramic telescope slipping azimuth scale — not to exceed one 100-mil graduation.
- (d) Panoramic telescope slipping micrometer scale — not to exceed ten 1-mil graduations.
- (e) Elbow telescope range lines — not to exceed 200 meters.

c. Outline of Tests.

Test number	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.	Performs test prescribed in paragraph 49. Calls "Correction (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Performs test prescribed in paragraph 50. Calls "Quadrant micrometer is (is not) in error" and states any further action which should be taken.
3	TEST PANORAMIC TELESCOPE MOUNT.	<i>a. Performs test of telescope mount.</i> Levels the telescope mount and traverses the tube so

Test number	Examiner commands	Action of candidate
3	TEST PANORAMIC TELESCOPE MOUNT — Continued.	that the line of sight is on the plumb line. Directs the assistant gunner and number 2 in elevating the tube and in traversing the tube, if necessary to keep the vertical hairline of the reticle on the plumb line. Reports deviation to examiner and states action necessary. <i>b. Performs telescope mount cross-level test.</i> Levels the tube longitudinally, using gunner's quadrant. Centers the cross-level bubble. Causes the tube to be elevated to maximum elevation, keeping the cross-level vial level. Reports any deviation of the cross-level vial and any action necessary. <i>c. Performs telescope mount longitudinal level test.</i> Levels the tube longitudinally, using gunner's quadrant. Centers the longitudinal-level bubble. Operates the cross-leveling knob throughout its limits. Reports any deviation of the longitudinal-level bubble and any action necessary.

Test number	Examiner commands	Action of candidate
3	TEST PANORAMIC TELESCOPE MOUNT — Continued.	<i>d. Performs telescope socket alinement test.</i> Zeros the azimuth and micrometer scales on the panoramic telescope. Traverses the tube and places the vertical line of the panoramic telescope reticle on the plumb line. Rotates the elevation knob throughout its extent of travel. Reports any deviation of vertical line of reticle and any action necessary. <i>Note.</i> Prior to test 4, the cross- and longitudinal-leveling of the tube will be verified by the examiner, and the testing target will be alined (par. 35) by the candidate with the help of his selected assistants.
4	TEST ADJUST- MENT OF PANORAMIC TELESCOPE.	Performs tests and makes adjustments described in paragraph 35c. Calls "Ready" and steps clear.
5	TEST ADJUST- MENT OF ELBOW TELESCOPE.	Performs test and makes adjustments described in paragraph 35d. Calls "Ready" and steps clear. <i>Note.</i> Prior to test 6, the cross-level bubble of the quadrant mount will be moved off center, and the gunner's quadrant will be set at a reading other than zero.

Test number	Examiner commands	Action of candidate
6	TEST QUADRANT MOUNT.	Performs cross-level and longitudinal tests of quadrant mount. Calls "Quadrant mount is (is not) in adjustment" and states any further action necessary.

d. Penalties. The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.

(1) *Test 1.* No credit will be allowed if —

- (a) The bubble of the gunner's quadrant does not center when verified by the examiner.
- (b) The correction (one-half of the amount of the angle which was indicated when the quadrant first was reversed and the bubble was centered by moving the index arm and micrometer) is announced incorrectly by the candidate.
- (c) The candidate fails to declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil or fails to declare the quadrant serviceable if the error (necessary correction) is 0.4 mil or less.
- (d) The time to complete the test exceeds 2 minutes.

- (2) *Test 2.* No credit will be allowed if —
- (a) The procedure is not followed correctly.
 - (b) The time to complete the test exceeds 1 minute.
 - (c) The candidate fails to report necessary action to be taken.
- (3) *Test 3.* No credit will be allowed if —
- (a) The candidate does not announce correctly in regard to the status of either the cross-level or the longitudinal-level bubble.
 - (b) The candidate does not correctly measure deviations.
 - (c) The candidate fails to report proper action to be taken.
 - (d) The time to complete the test is more than 2 minutes.
- (4) *Test 4.* No credit will be allowed if —
- (a) The candidate fails to make the adjustment indicated.
 - (b) The rotating head elevation indexes are not in coincidence.
 - (c) The zero line of either the azimuth scale or azimuth micrometer scale is not in coincidence with its index.
 - (d) The center line of the bore, as viewed through the boresights, or the line

of sight of the telescope does not fall on its aiming point on the testing target when all scales are set at zero.

- (e) The time to complete the test and adjustments exceeds 4 minutes and 30 seconds.

(5) *Test 5.* No credit will be allowed if —

- (a) The range lines of the reticle are not horizontal.
- (b) The cross on the reticle does not fall on the aiming point.
- (c) The time to complete the test and adjustments exceed 1 minute.

(6) *Test 6.* No credit will be allowed if —

- (a) The candidate fails to center the cross-level bubble prior to elevating and depressing the tube.
- (b) The candidate neglects zeroing the gunner's quadrant prior to performing the longitudinal-level test.
- (c) The time to complete the two tests exceeds 2 minutes.

e. Credit.

- (1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.
- (2) If the tests and adjustments are performed correctly within the prescribed time

limit, maximum credit will be given as follows :

Test 1	2
Test 2	1
Test 3	1
Test 4	4
Test 5	1
Test 6	1
Total	10

95. Materiel

a. Scope of Tests. The candidate will be required to perform three tests as outlined in *c* below.

b. Special Instructions.

(1) *Tests 1 and 2.* For tests 1 and 2, a tarpaulin will be placed on the ground for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests. The candidate may select assistants to aid him in lowering and lifting the breechblock.

(2) *Test 3.*

(a) A complete set of lubrication equipment authorized for use of battery personnel will be placed on a tarpaulin near the howitzer.

(b) Every type of lubricant used on the howitzer will be available in plainly labeled containers.

c. Outline of Tests.

Test number	Examiner commands	Action of candidate
1	DISASSEMBLE BREECH MECHANISM AND FIRING MECHANISM.	Performs the operation as described in TM 9-3004, laying the parts on the tarpaulin. After disassembly, identifies all parts to examiner.
2	ASSEMBLE BREECH MECHANISM AND FIRING MECHANISM.	Performs the operation as described in TM 9-3004.
3	PERFORM DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Selects proper lubricating equipment and lubricant and tells <i>how</i> , <i>when</i> , and with <i>which</i> lubricant each lubrication point is serviced. (Actual lubrication is not performed.)

d. Penalties.

- (1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.
- (2) No credit will be given if the following time limits are exceeded:

Test 1 12 minutes

Test 2 16 minutes

Test 3 5 minutes

- (3) A penalty of one-half point will be assessed for each part not correctly identified or omitted in test 1. There is no time limit imposed on the identification of parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the nomenclature.
- (4) A penalty of one-half point will be assessed for each lubrication point missed and for each lubricating device and each lubricant improperly selected.

e. Credit.

- (1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.
- (2) A maximum credit of 5 points will be given for each test which is performed correctly within the prescribed time limit.

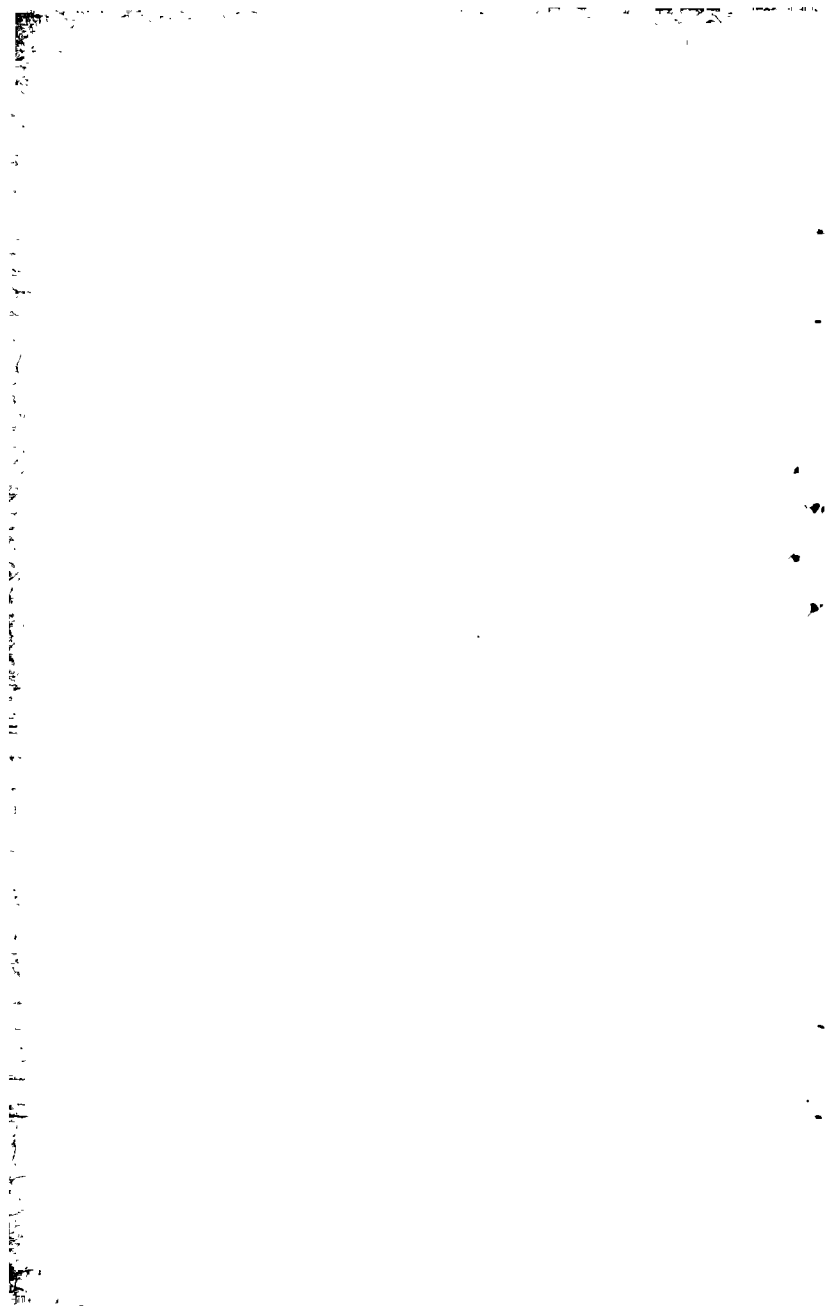
APPENDIX

REFERENCES

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 611-201	Manual of Enlisted Military Occupational Specialties.
AR 672-5-1	Awards.
AR 750-5	Organization, Policies, and Responsibilities for Maintenance Operation.
ATP 6-100	Army Training Program for Field Artillery Units.
ATT 6-137	Field Artillery Howitzer Battery 8-Inch, Infantry Division.
DA Pam 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 310-series	Index of Military Publications.
FM 5-15	Field Fortifications.
FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-25	Explosives and Demolitions.
FM 6-20-2	Field Artillery Techniques.

FM 6-40	Field Artillery Cannon Gunnery.
FM 6-125	Qualification Tests for Specialists Field Artillery.
FM 6-140	The Field Artillery Battery.
FM 21-5	Military Training.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Nuclear, Biological and Chemical Warfare.
FM 21-60	Visual Signals.
FM 22-5	Drills and Ceremonies.
FM 25-10	Motor Transportation, Operations.
FM 31-70	Basic Cold Weather Manual.
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 9-238	Deep Water Fording of Ordnance Materiel.
TM 9-575	Auxiliary Sighting and Fire Control Equipment.
TM 9-1527	Ordnance Maintenance: Gunner's Quadrants M1 and M1918 and Machine Gun Clinometer M1917.
TM 9-1300-203	Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons.
TM 9-1590	Fuze Setters, M14, M22, M23, M25, and M27.
TM 9-1900	Ammunition, General.

TM 9-2300	Artillery Materiel and Associated Equipment.
TM 9-1100-218-20P	Organizational Maintenance Repair Parts and Special Tools List Illustrated Parts Break-down Projectile Atomic 8-Inch (U)
TM 39-B33-9	Before Loading Procedures, Projectile Atomic 8-Inch (U).
TM 9-3004	8-Inch Howitzer M2, Carriage M1, and Heavy Carriage Limber M5.
TM 21-301	Driver Selection, Training and Supervision; Tracked Vehicles.
TM 38-750	Army Equipment Records System and Procedures.
LO 9-335	Lubrication Instructions.
SM 9-5-1315	Ammunition, 75-mm through 125-mm.
SM 9-5-1390	Ammunition and Explosives, Fuses, and Primers.



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By Order of the Secretary of the Army:

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6-415 (2); 6-416 (2); 6-417 (3); 6-501 (2).

USAR: Same as active Army except allowance is one copy each
unit except Centers (none).

For explanation of abbreviations used, see AR 320-50.

Table 1. Duties in Uncoupling

Sequence	Chief of section	Gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Remainder of section	Driver
1	Commands UNCOUPLE. Supervises operation throughout all sequences.	Directs work of personnel performing uncoupling operations.	Detaches blackout lighting system from prime mover. Closes service output cock on prime mover. Uncouples service line and connects dummy coupling.	Closes emergency output cock on prime mover. Uncouples emergency line and connects dummy coupling.	Sets carriage handbrakes and bleeds air reservoir on carriage.	Checks bogie wheels.	Releases chain hoist from traveling position.		Unload section equipment under supervision of assistant gunner.	
2				Secures chain hoist in working position.	Uncouples emergency line from trail; connects dummy coupling.	Uncouples service line from trail; connects dummy coupling.	When trails are to be lowered and blocked, secures blocks and arranges them under the trails.			
			Passes end of service line to number 4.	Passes end of emergency line number 3.	Receives other end of emergency line from number 2.	Receives other end of service line from number 1.				
3			Attach hooks of chain hoist to trail clamping bracket and operate hoist to take up weight of the trails and free trail coupling hitch pin.		Couples ends of emergency line together.	Couples ends of service line together.				
					Receives service line from number 4.	Passes service line to number 3.				
4			Inserts right front spade key.	Inserts left front spade key.	Assisted by number 5, removes right front spade and places it in position.	Assisted by number 6, removes left front spade and places it in position.	Assists number 3 in removing right front spade and placing it in position.	Assists number 4 in removing left front spade and placing it in position.		
			Assisted by number 2, removes trail coupling hitch pin.	Assists number 1 in removing trail coupling hitch pin.						
5			Operates chain hoist to lower trails to blocking or to the ground.							
			Replaces trail coupling hitch pin.	Replaces trail coupling pin key.						
6			Detach hooks of chain hoist from trail clamping bracket and secure hoist for traveling.							
				Replaces chain hoist pin.						
7		Directs driver to move prime mover forward.								Moves prime mover forward on signal of gunner.

Table 1.



Table IV. Trajectory Characteristics, Shell HE, Charge 7

Range (meters)	Elevation	Vertical displacement per 100-meter range change (feet)	Trajectory characteristics	Firing data
100 200 300 400 500	1 3 4 6 7	0.5 1.0 1.0 1.5 2.0	For ranges from 0 to 500 meters, the trajectory is flat enough to prevent an 8-foot tank from passing under it. Five hundred meters is the ideal range at which to open fire, because fire can be conducted for the maximum time without misses if deflection is correct.	Start firing with the data for the estimated range at the closest 100-meter range.
600 700 800 900 1,000 1,100 1,200 1,300 1,400 1,500 1,600 1,700	9 10 12 14 15 16 18 20 21 23 24 26	2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 8.0 8.5	For ranges from 500 to 1,800 meters, the trajectory is sufficiently flat to permit direct range estimation without having to bracket the target. If a hit is obtained at the bottom of an 8-foot tank, firing at the upper range limit, the addition of a 100-meter range change will result in a round that will just brush the top of the tank. Range changes will seldom be more than 100 meters, and frequently 50-meter changes will be sufficient. 1,800 meters is the maximum range at which a tank should be fired on unless tactical condition requires otherwise.	1. Start firing with the data for the estimated range at the closest 100-meter range. 2. Make range changes with 50- or 100-meter increments. 3. The establishment of a bracket on the target (overs and shorts) is not required.
1,800 1,900 2,000 2,100 2,200 2,300 2,400 2,500	28 30 31 33 35 36 38 40	9.0 9.5 10.5 11.0 12.0 12.5 13.0 13.5	For ranges from 1,800 to 3,000 meters, hits are only reasonably possible. Adjustment of fire on the target by bracketing normally is required. At ranges over 2,300 meters, direct laying is too inaccurate for use against moving targets.	1. Start firing with the data for the estimated range at the closest 100-meter range. 2. Adjustment on the target by bracketing (overs and shorts) is required. 3. Surprise effect on the target must not be important.

Note. The values shown in the elevation column are for targets at the same altitude as the weapon. The chief of section should correct the elevation for difference in altitude between the weapon and the target as shown in the firing tables.

Table IV.

Table VII. Duties in Coupling

Sequence	Chief of section	Gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Remainder of section	Driver
1	Commands COUPLE. Supervises the operation.	Directs work of personnel performing coupling operation.	Removes trail coupling hitch pin.	Removes trail coupling pin key.					Load section equipment or perform other duties as directed by chief of section.	Maneuvers prime mover as signaled by gunner.
2			Attach hooks of chain hoist to trail clamping bracket and operate hoist to raise trails to coupling position.							
			Replaces trail coupling hitch pin.	Replaces trail coupling pin key.						
3			Replaces right front spade key in bracket.	Replaces left front spade key in bracket.	Assisted by number 5, replaces right front spade in bracket.	Assisted by number 6 replaces left front spade in bracket.	Assists number 3.	Assists number 4.		
4			Detach chain hoist hooks from trail clamping bracket.		Obtains service and emergency brake lines.					
					Passes service line to number 4.	Receives service line from number 3.				
5					Uncouples ends of emergency line.	Uncouples ends of service line.	Secures chain hoist in traveling position.			
			Receives end of service line from number 4.	Receives end of emergency line from number 3.	Passes one end of emergency line to number 2.	Passes one end of emergency line to number 1.				
6			Disconnects dummy coupling on prime mover. Couples service line and opens service output cock.	Inserts key to lock chain hoist in traveling position.	Disconnects dummy coupling on trail and couples trail end of emergency line.	Disconnects dummy coupling on trail and couples trail end of service line.				
				Disconnects dummy coupling on prime mover. Couples emergency line and opens emergency output cock.						
7			Connects blackout lighting system to prime mover.	Releases carriage hand-brakes.		Removes chocks from bogie wheels.	Removes chocks from trails.			

Table VII

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Table II. Duties in Preparing for Action

Sequence	Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Number 9	Number 10	Driver
1	Directs the driver in positioning the howitzer. Commands PREPARE FOR ACTION. Supervises activities of the section.	Directs work of howitzer section throughout all sequences.	Assists numbers 8, 9, and 10 in sequences 1 through 3. Mounts bogie wheels, folds cover toward breech by making two 2½-foot folds, and folding the front corners diagonally to point marked "center."	Remove trail clamping bracket from trails and place it clear of the howitzer to the right.	Remove loading tray and place it to the right of the howitzer.	Remove blackout lighting system and reflectors and place with section equipment.	Digs front spade pit.	Remove overall gun cover as prescribed in sequences 1 through 3.		Mounts bogie wheels and assists the assistant gunner in folding cover.		Unfasten the overall gun cover. Grasp lower edge of cover at a point directly beneath the breech, mount the trails, and fold rear of cover up over the breech to a point marked "center" on top of cover. Caution: Do not permit cover to become lodged under handwheels or on other projections.		Moves prime mover directed by chief of section.
2				Spread right and left trails, respectively, assisted by numbers 3, 4, 5, and 6. Mark positions of right and left spade, respectively. Partially close spades assisted by numbers 3, 4, 5, and 6.	Assists number 1 in spreading right trail. Assists number 1 in partially closing right trail.	Assists number 2 in spreading left trail. Assists number 2 in partially closing left trail.	Assists number 1 in spreading right trail. Assists number 1 in partially closing right trail.	Assists number 2 in spreading left trail. Assists number 2 in partially closing left trail.			Fold sides of cover toward center so that it forms a bundle about 4 feet wide, then fold cover toward tube in two folds about 3 feet long.			
3			Receives folded cover from numbers 9 and 10. Places it on the ground to the right of the howitzer about 3 yards from and directly opposite the rear bogie wheel.	Replace bolts, nuts, and safety pins in trail clamping bracket; place trail clamping bracket and wrench with section equipment.	Digs right trail spade pit.	Digs left trail spade pit.	Secures ratchet wrench from trail and places it on right bogie screw.	Secures ratchet wrench from left trail and places it on left bogie screw.	Remove bogie lifting screw covers and lock; place them with section equipment. Attach right and left wheel support cables, respectively.		Pass folded cover to the assistant gunner.			
4		Inserts key in left spade.	Inserts key in right spade.	Reopens right trail assisted by number 3. Assisted by number 3, holds spade in position while assistant gunner inserts key.	Reopens left trail assisted by number 4. Assisted by number 4, holds left spade in position while gunner inserts key.	Assists number 1 in re-opening right trail. Assists number 1 in holding right spade in position.	Assists number 2 in re-opening left trail. Assists number 2 in holding left spade in position.	Assisted by numbers 7 and 9 and in unison with numbers 6, 8, and 10, operates right bogie wrench to lower carriage and raise bogie.	Assisted by numbers 8 and 10 and in unison with numbers 5, 7, and 9, operates left bogie wrench to lower carriage and raise bogie.	Assists number 5 in operating right bogie wrench.	Assists number 6 in operating left bogie wrench.	Assists number 5 in operating right bogie wrench.	Assists number 6 in operating left bogie wrench. Procures materials for cleaning projectile.	
5		Removes panoramic telescope and elbow telescope from sight case. Installs panoramic telescope.	Obtains elbow telescope from the gunner and installs it in the telescope mount.	Procures lanyard, vent cleaning tool, oiler, waste, spare firing mechanism, and primer belt with primers.	Measures position of the oil index. <i>Note. In firing, the oil index should be measured after every tenth round or sooner as the chief of section may direct.</i>	Assembles sponge to one section of rammer staff, swabs the chamber, and places swab in bucket.	Remove section equipment from prime mover and prepare ammunition as directed by the chief of section.		Procures bucket of water and inbeds it in ground inside left trail.	Assembles three sections of loading rammer and places it near right trail with rammer head off the ground.	Procures fuze wrench and fuze setter. Opens and arranges fuzes as directed by the chief of section.		Unloads and arranges ammunition as directed by chief of section.	
							Assembles aiming posts and places them near left front of howitzer.		Remove ammunition from prime mover and perform other duties as directed by the chief of section.					
6	Inspects the materiel, making certain that the recoil and counterrecoil mechanisms contain the proper amount of oil and that the equilibrators function properly. Verifies adjustment of fire control equipment.	Operates traversing mechanism and centers cross-level bubble and longitudinal-level bubble on the telescope mount. Test and aline (check boresight) fire control equipment.	Removes gunner's quadrant from case, sets it at 150 mils, places it on seat, and centers cross-level bubble on quadrant mount.	Removes firing mechanism and opens breech. Cleans and oils firing mechanism. Examines breechblock, primer vent, breech recess, and gas check pad and cleans and oils where necessary.	Assists the assistant gunner in leveling the bubbles of gunner's quadrant by operating the elevating handwheel and setting the clutch lever. Centers cross-level bubble on quadrant mount.	Assists other cannoneers in removing section equipment or ammunition as the chief of section may direct.	Emplaces and holds testing target, if required.							
7	Receives ammunition count from number 10. *Measures sight to mask assisted by the gunner, assistant gunner, and number 2. 1. Sights along the lowest element of the bore. 2. Directs gunner, assistant gunner, and number 2 to operate the traversing and elevating mechanisms until the lowest element of the bore just clears the highest crest in the field of fire. 3. Directs assistant gunner to center cross-level and elevation bubbles and to measure the elevation at which the howitzer is laid, by means of the gunner's quadrant. 4. Reads elevation on gunner's quadrant and reports to the executive, "Sir, number (so-and-so) site (so much)." 5. Records and announces to the assistant gunner the minimum elevation for each charge.	*Lays howitzer for direction. 1. Executive commands AIMING POINT THIS INSTRUMENT, REFER. 2. Identifies aiming point through telescope and announces "Number (so-and-so), aiming point identified, sir." 3. Executive commands NUMBER (SO-AND-SO), DEFLECTION (SO MUCH). 4. Sets announced deflection on the azimuth scale. 5. Traverses the howitzer until reticle pattern of the telescope is centered on the objective lens of the aiming circle. 6. Checks that the bubbles are level. 7. Reports to the executive "Number (so-and-so) ready for recheck, sir." 8. Repeats steps in 4 through 7 above until executive announces "Number (so-and-so) is laid." (Lay of the tube will not be disturbed until an aiming point is fixed.)											Reports to chief of section the number of each type of projectile, fuze, and powder charge in the section.	
8	*Indicates alternate aiming point to the gunner when one is designated by the executive. If an alternate aiming point is not designated, the chief of section should select a clearly defined point at a distance of at least 3,000 meters. These aiming points are to be used as directed by the executive, or at such times when the aiming points are rendered useless. Deflections read from the azimuth scale are recorded and reported to the executive and used to maintain parallelism until the aiming posts are reemplaced.	*Directs alinement of aiming posts. 1. Sets the panoramic telescope at deflection 2600. 2. Directs number 5 by hand signals in the alinement of the posts with the vertical reticle of the sight. <i>Note. If because of the nature of the terrain, the aiming posts cannot be set out at deflection 2600, the gunner turns the azimuth micrometer knob until the slipping azimuth scale is on another even hundred mill graduation and alines the posts at this new deflection. The chief of section will report the altered deflection to the executive, "Number (so-and-so), aiming posts at deflection (so much), deflection 2600 in lake (or other reason)."</i> The executive will command NUMBER (SO-AND-SO), DEFLECTION, REFER COMMON DEFLECTION 2600. The gunner loosens the slipping azimuth scale and moves it until 2600 is in coincidence with the index on the door, and zeros the slipping azimuth micrometer scale. He then verifies that zero is in coincidence with the indexes. Lays on alternate aiming point. 1. Piece has been laid. 2. The executive may command AIMING POINT, LEFT FRONT, LONE TREE, REFER. 3. Without moving the tube, refers the sight to the aiming point. 4. Reads the deflection from the azimuth scale and reports "Number (so-and-so), deflection (so much)." <i>Note. At this point the executive may record the referred deflection for future use or he may command COMMON DEFLECTION 2600.</i>					Sets out aiming posts as directed by the gunner. The far aiming post is placed approximately 100 meters from the piece and the near aiming post 50 meters from the piece. <i>Note. If because of the nature of the terrain, the far aiming post is put out at any distance other than 100 meters, the near aiming post should be one-half the distance of the far aiming post.</i>							

Note. All cannoneers take posts after they have performed their specific duties. *During training these steps may be omitted when drill does not include laying of the piece.

Table III. Duties in Firing, Indirect Laying

Chief of section	Gunner	Assistant gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Number 9	Number 10	Driver
Commands the section during firing and insures an efficient and safe operation. Follows fire commands and repeats commands to the section, as required, to accomplish mission.	Sets and lays for deflection. 1. The command is DEFLECTION (SO MUCH). 2. Sets announced deflection on the panoramic telescope by disengaging the throwout lever with his left thumb and turning the rotating head of the site to the nearest 100 mils. He releases the throwout lever and with his right hand turns off the remaining number of mils on the micrometer scale. 3. Traverses the piece until the vertical line of the telescope is on the left edge of the aiming point. 4. Centers bubbles. <i>Note.</i> Final motion in traversing is from left to right. Final deflections are set in increasing direction on the micrometer scale. Calls "Ready" after the piece is laid for direction and the assistant gunner has called "Set." Corrects for aiming post displacement when the vertical hairline in the panoramic telescope is displaced from the line formed by the aiming post. He lays the howitzer so that the far aiming post appears exactly mid-way between the near aiming post and the vertical hairline.	Sets and lays for quadrant. 1. Command is QUADRANT (SO MUCH). 2. Sets announced quadrant on the gunner's quadrant. 3. After the piece is loaded, elevates or depresses the tube until the bubble of the gunner's quadrant is centered exactly. 4. After number 1 has inserted the firing mechanism, the assistant gunner verifies that both the cross-level and quadrant bubbles are centered and calls "Set." <i>Note.</i> Final motion in laying for elevation is in the direction of the greatest resistance. Depresses the tube to the loading position after each round is fired. <i>*Measures the quadrant.</i> 1. The command is MEASURE THE QUADRANT. 2. With the howitzer laid, he sets the plunger plate at zero and the micrometer and its index in coincidence. 3. Places the gunner's quadrant on the quadrant seats. 4. Raises and lowers the index arm and turns the micrometer until the bubble is centered. 5. Reads and announces the quadrant measured. <i>*As directed by the executive.</i>	Opens and closes the breech. 1. Removes firing mechanism. 2. Releases the breech operating lever catch, pulls the operating lever downward to the horizontal position, and swings the lever to the right until the breech is fully opened. 3. After number 3 commands CLOSE, reverses the procedure in opening the breech. <i>To prime the howitzer.</i> 1. Locks the percussion hammer with hammer locking pin knob and detaches the lanyard. 2. Disengages firing mechanism safety plunger and unscrews firing mechanism. 3. Inserts primer into firing mechanism. 4. After the projectile and charge have been loaded, closes the breech. 5. Places left hand over percussion hammer and inserts firing mechanism into housing, turns the handle clockwise until it contacts block handle arm stop and is latched. <i>Caution: If firing mechanism is not properly seated, damage and injury may result to personnel and materiel. Oversized primers and dirty primer seats will cause the mechanism to stick before it is fully seated. Force should not be used to seat the firing mechanism.</i> 6. After seating the firing mechanism and after the assistant gunner and gunner have called "Set" and "Ready" attaches the lanyard. 7. <i>To fire the howitzer.</i> Fires the howitzer at the command of the chief of section with a quick, strong pull on the lanyard. 8. <i>To clean and oil breech mechanism.</i> (1) Cleans primer vent with vent tool. (2) Removes residue from primer seat with primer seat reamer. (3) Cleans gas check seat and threaded sections of breechblock and recess with water. (4) Oils the parts with a cloth slightly dampened with oil as prescribed in LO 9-3004. <i>To clean and oil firing mechanism.</i> Two firing mechanisms are provided. They should be used alternately. As soon as one is inserted into the breechblock, clean and oil the other for use with the next round.	Operates the elevating mechanism clutch lever while the howitzer is being laid for elevation by the assistant gunner. Depresses the clutch lever to release the clutch. After howitzer has been elevated and bubble has been centered by the assistant gunner, releases clutch lever to engage the clutch, thus securing the howitzer in elevation. To cross-level the quadrant mount. Turns the cross-leveling knob until bubble is centered. After howitzer is laid for elevation and before removing gunner's quadrant, verifies the cross-leveling of the quadrant mount. Measures the position of the oil index. After every tenth round or more often if directed by the chief of section, measures the position of the oil index. Holds metal rule firmly against face of oil index housing on the counter-recoil cylinder. With the edge of the rule parallel to the oil index, reads and reports the position of the index to the chief of section.	Loads the propellant charge. 1. Immediately after the projectile has been rammed, receives a prepared propellant charge from number 8 and takes it to the howitzer. <i>Note.</i> At no other time will an exposed charge be near the howitzer. 2. Inserts propellant charge in the chamber so that the igniter pad is 3 inches inside the rear of the chamber (lashed end forward). 3. Commands CLOSE. After placing propellant charge into the chamber and removing hand from breech recess, commands CLOSE to notify number 1 that it is safe to close the breech. Swabs and inspects powder chamber and forcing cone after each round is fired and calls "Bore clear."	Rams the projectile after the loading tray has been placed in the breech recess by numbers 6, 7, 9, and 10, assisted by number 5, pushes the projectile off the loading tray into the breech. Numbers 4 and 5 turn their backs to the breech and, assisted by numbers 6 and 7, ram the projectile at the command RAM given by number 4. Calls out the number and quadrant for each round in volley fire. Assist in preparing ammunition as directed by the chief of section. <i>Note.</i> During lulls in firing, numbers 4, 5, 6, and 7 will swab out the bore, wash powder residue from the mushroom head, gas check seats, and the threaded section of the breech recess and breechblock.	Assists number 4 in ramming the projectile.	Assists numbers 4 and 5 in ramming the projectile.	Assists numbers 4, 5, and 6 in ramming the projectile.	Prepares propellant charge. <i>Note.</i> Two types of charges are available for issue. 1. Charge M1, green bag, consists of five increments, 1 to 5. Increment 1 is the base charge. Increments 2, 3, 4, and 5 are unequal charges. 2. Charge M2, white bag, consists of three increments. The base charge is equivalent to charge 5. Increments 6 and 7 are unequal charges. The executive will designate the charge to be used. 1. The command is CHARGE 3, GREEN BAG. 2. Removes complete charge from container, placing base charge on bottom. 3. Unties the lashings. 4. Removes bags marked "4" and "5." 5. Ties remaining bags together. 6. Removes igniter protector cover. 7. Discards charges 4 and 5, as directed. 8. Passes charge to number 3 and calls "Charge 3, green bag." <i>Note.</i> At no other time will an exposed charge be near the howitzer. 9. The same procedure is followed in preparing the white bag except that no charge lower than charge 5 can be prepared. <i>Note.</i> Green and white bag increments must not be mixed together in the same charge. The M3 flash reducer is used only with white bag propellants. Green bag propellant is flashless under all conditions. The flash reducer is assembled as prescribed in TM 9-3004.	<i>Fuzes projectiles.</i> 1. Removes lifting plug. 2. Inspects fuze socket for rust and dirt. 3. Removes or replaces supplementary charge as required. 4. Screws in designated fuze with authorized fuze wrench. <i>Caution: Do not hammer on a fuze wrench or use an extension handle.</i> Remove safety pull wire from time fuze. <i>Sets fuzes with fuze setter M26.</i> 1. Uses the following fuzes: M54, M55, M67, M500, and M520. 2. Seats upper lug of fuze setter in the upper recess of fuze. 3. Loosens wingnut on setter, sets announced time on the appropriate time band. 4. Locks wingnut, places handle to horizontal, turns counterclockwise until a stop is felt and a click is heard. 5. Raises handle, removes setter, and verifies setting. <i>With fuze setter M27.</i> 1. Engages key of the fuze setter in the notch on the setting ring of the fuze. 2. Rotates fuze setter in the direction of increasing readings until announced time is opposite index mark on the fuze. <i>Note.</i> This is a wrench type fuze setter and should not be used when mechanical fuze setters are available. <i>With fuze setter M28.</i> 1. Used with fuze VT M514-series. 2. Seats stationary lug of setter into top recess of fuze. 3. Sets announced time on the fuze setter. 4. Turns fuze setter clockwise until it stops or a click is heard. 5. Removes setter and verifies setting. <i>Selective superquick and delay fuzes.</i> <i>Fuze Quick.</i> Verifies that letters "SQ" are alined with slot on the setting sleeve. <i>Fuze Delay.</i> Turns sleeve with wrench or screwdriver until the slot is alined with the word delay. <i>Combination time and superquick fuzes.</i> For impact the command is FUZE M500 (or other fuze) QUICK. Verifies that "S" on the time ring is alined with the index and alines if required. <i>Caution: A time fuze should be returned to ordnance after being set twice.</i>	Inspects and cleans projectiles. 1. Verifies that projectile is type designated in the command. 2. Removes grommet and examines rotating band to see that it is free from all dirt and burrs. 3. Examines entire projectile for defects. 4. Stands projectile on end and cleans it thoroughly. <i>Notes.</i> (1) A projectile with a burred rotating band will be set aside until burrs can be removed with a file. (2) Any sand, dirt, oil, or grease on the projectile will cause wear, scratches or gouges in the bore. Holds projectile upright while number 9 fuzes and sets the fuze. Selects proper projectile as commanded.	Performs maintenance on the prime mover and other duties as directed.

Table VI. Duties in March Order

Sequence	Chief of section	Gunner	Assistant Gunner	Number 1	Number 2	Number 3	Number 4	Number 5	Number 6	Number 7	Number 8	Number 9	Number 10	Driver
1	Commands MARCH ORDER. Supervises operation throughout all sequences.	Directs work of howitzer section throughout all sequences.	Sets gunner's quadrant at 150 mils and places it on quadrant mount seat.			Disassembles sponge from rammer staff and places sponge and staff with section equipment.	Assists in preparing equipment for loading when otherwise engaged.	Secures aiming posts for traveling.	Assists in preparing equipment for loading when not otherwise engaged.	Empties buckets and places them with section equipment.	Disassembles rammer staff and prepares it for traveling.	Returns fuze wrench and hand setter to tool chest.	Returns loading tray to section equipment.	Moves prime mover as directed by chief of section.
		Traverses howitzer to approximate center and centers crosslevel bubbles on telescope mount.	Assisted by number 2, levels gunner's quadrant by operating the elevating handwheel.	Cleans and oils breech-block and firing mechanism. Closes breech.	Assists the assistant gunner in leveling gunner's quadrant by operating the elevating clutch lever.									
2	Inspects bore and powder chamber.		Returns gunner's quadrant to tool chest.	Returns lanyard, vent cleaning tool, oiler, and spare firing mechanism to tool chest.		Replaces ammunition, equipment, and accessories in prime mover in any sequence where not otherwise engaged.					Replace ammunition, equipment, and accessories in prime mover when not otherwise engaged.			
		Passes elbow telescope to gunner.												
		Returns panoramic telescope to sight case, receives elbow telescope from assistant gunner and places it in sight case.												
3		Removes left spade key.	Removes right spade key.	Assisted by number 3, removes right spade and places it in bracket.	Assisted by number 4, removes left spade and places it in bracket.	Assists number 1 in removing right spade.	Assists number 2 in removing left spade.	Place ratchet wrenches in position on bogie screws.		Assists number 5 in operating right bogie wrench.	Assists number 6 in operating left bogie wrench.	Assists number 5 in operating right bogie wrench.	Assists number 6 in operating left bogie wrench.	
								Assisted by number 7 and 9 and in unison with 6, 8, and 10, operates right bogie wrench to raise carriage to traveling position.	Assisted by numbers 8 and 10 and in unison with 5, 7, and 9, operates left bogie wrench to raise carriage to traveling position.					
4				Assisted by number 3, closes right trail.	Assisted by number 4, closes left trail.	Assists number 1 in closing right trail.	Assists number 2 in closing left trail.	Secure ratchet wrenches in position for traveling.		Replace bogie lifting screw covers and lock.		Replace breech and muzzle cover.		
			Passes gun cover to numbers 9 and 10.							Removes right wheel support cable and secures for traveling.	Removes left wheel support cable and secures for traveling.			
5			Unfolds sides of cover.	Place trail clamping bracket over the trails in line with the T-bolt and assemble the bracket.		Secure loading tray on trails.		Attach blackout lighting system and reflectors.			Unfold cover two folds toward center.			
			Unfolds front corners of cover and unfolds cover from center.											Unfold cover over breech.
6											Position cover for closing.			
										Fasten overall gun cover.				

Table VI

Table V. Duties in Direct Laying

Chief of Section	Gunner	Assistant gunner	Numbers 1 through 6	Driver																																											
<i>Conducts fire of howitzer:</i> 1. Takes control of his section and fires the howitzer when the executive commands TARGET, TANK, RIGHT (left) FRONT, FIRE AT WILL or simply FIRE AT WILL. 2. Alerts section to prepare for direct fire. <i>Identifies or selects target:</i> 1. Identifies target designated by executive. 2. If target is a group of vehicles, selects target that is the greatest threat to his position or the supported position based on the following priority: a. Tanks at short range threatening to overrun the position. b. Hull down stationary tanks covering the advance of other tanks. c. Area containing personnel threatening to overrun the position. 3. Repeats target designation to the section, e.g., "Lead tank" or "Moving tank." <i>Takes post to the flank and slightly to the rear of the piece where his observation will not be obscured by muzzle blast and smoke.</i> <i>Estimates range to target:</i> 1. Range cards (fig. 8) with accurate measurements to key points provides the most accurate ranges. 2. Estimated ranges are used if accurate measurements are not available. 3. Ranges from 400 to 1,800 meters are the most effective ranges to open fire (see table IV). <i>Determines lead in mils:</i> Lead is based on target speed, range, direction of travel, and ammunition used. Approximate initial leads are as follows: <table><tr><th rowspan="2">Speed (MPH)</th><th colspan="2">Lead in mils</th></tr><tr><th>Target traveling perpendicular to line of fire Shell HE, charge 7</th><th>Target traveling 45° to line of fire Shell HE, charge 7</th></tr><tr><td rowspan="2">Slow</td><td>5</td><td>5</td></tr><tr><td>10</td><td>5</td></tr><tr><td rowspan="2">Medium</td><td>15</td><td>10</td></tr><tr><td>20</td><td>15</td></tr><tr><td rowspan="2">Fast</td><td>25</td><td>15</td></tr><tr><td>30</td><td>20</td></tr></table> <i>Gives initial commands:</i> <table><tr><th>Sequence</th><th>Element</th><th>Example</th></tr><tr><td>1</td><td>Target designation</td><td>TARGET (Tank, etc.)</td></tr><tr><td>2</td><td>*Projectile, charge, and fuze</td><td>SHELL HE*, CHARGE 7, FUZE QUICK, or SHELL HE, CHARGE 7, FUZE DELAY</td></tr><tr><td>3</td><td>Lead</td><td>LEAD, RIGHT (left) 10</td></tr><tr><td>4</td><td>Method of fire</td><td>Fire is continuous unless otherwise commanded</td></tr><tr><td>5</td><td>Range</td><td>RANGE 600.</td></tr></table> <i>Gives subsequent commands based on observed effect:</i> 6 Change in lead RIGHT (left) 5 (given in 5-mil increments) 7 Change in range ADD (drop) 100 <i>*Ammunition and fuze selection:</i> 1. Shell HE, charge 7, fuze quick, is normally the most effective combination for direct fire because of the following: a. Speed and ease of adjustment. b. Highest forward motion to projectile and fragments. c. Most effective fuze action against armor and personnel at close ranges. 2. Shell, white phosphorous, may be used to set stalled tanks and other vehicles afire and produce casualties. 3. Fuze delay may be used for ricochet effect. The point of impact is adjusted 10 to 30 meters in front of the target. If less than 50 percent of the bursts ricochet, change to fuze quick. 4. Fuze time is the least desirable and should be used at ranges of 1,000 meters or greater. Areas effectively covered by air and ricochet bursts are similar. <i>Commands END OF MISSION when target is destroyed or neutralized.</i> New targets are selected and taken under fire as outlined above.	Speed (MPH)	Lead in mils		Target traveling perpendicular to line of fire Shell HE, charge 7	Target traveling 45° to line of fire Shell HE, charge 7	Slow	5	5	10	5	Medium	15	10	20	15	Fast	25	15	30	20	Sequence	Element	Example	1	Target designation	TARGET (Tank, etc.)	2	*Projectile, charge, and fuze	SHELL HE*, CHARGE 7, FUZE QUICK, or SHELL HE, CHARGE 7, FUZE DELAY	3	Lead	LEAD, RIGHT (left) 10	4	Method of fire	Fire is continuous unless otherwise commanded	5	Range	RANGE 600.	Prepares panoramic telescope for direct laying: 1. Initially, cross-levels panoramic telescope mount. 2. Sets azimuth scales of the panoramic telescope at zero. 3. Verifies that gunner's aid micrometer is zero. Sets initial lead announced by Chief of Section on the horizontal reticle scale. The gunner then tracks the target using the traversing hand-wheel to keep the appropriate vertical grid line in the reticle of the telescope ON CENTER OF target. Commands FIRE, after the assistant gunner calls "Set." Immediately after each round is fired, check that the cross-level bubble is centered. <i>Note.</i> The gunner and assistant gunner, as a team, track the target in deflection and elevation while adjusting for the correct sight picture. They continue tracking after the round is fired and make corrections as directed by the chief of section. Actions taken for subsequent commands. While the gunner and assistant gunner continue to track the target, the chief of section gives commands based on observed effects. The chief of section commands <table><tr><th>RIGHT (left) (so much)</th><th>ADD (drop) (so much)</th></tr><tr><td>1. Traverses the piece until the appropriate vertical grid line is again centered on the target.</td><td>1. Elevates or depresses the piece until the appropriate range line is centered on the mass of the target.</td></tr><tr><td>2. Commands FIRE after the assistant gunner has called "Set."</td><td>2. Calls "Set."</td></tr></table>	RIGHT (left) (so much)	ADD (drop) (so much)	1. Traverses the piece until the appropriate vertical grid line is again centered on the target.	1. Elevates or depresses the piece until the appropriate range line is centered on the mass of the target.	2. Commands FIRE after the assistant gunner has called "Set."	2. Calls "Set."	Elevates or depresses the piece until the target is on the appropriate range line in the reticle. Maintains target on appropriate range line by continuous tracking. Calls "Set." <i>Note:</i> A canted reticle in the elbow telescope introduces an unacceptable range error and prevents satisfactory direct fire on moving targets.	Perform the same duties as in indirect laying. Performs same duties as in indirect laying.
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